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# Rust fungi causing galls, witches' brooms, and other abnormal plant growths in northwestern Argentina

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***Abstract:*** Conspicuous galls and witches' brooms frequently are symptoms of rust infections on plant hosts in the ecologically diverse northwestern region of Argentina. These symptoms are caused by systemic or locally systemic spermogonial-aecial infections, although uredinial and telial infections also might be involved. Sixteen species of rust fungi are treated in this paper, most of which cause a plant response that results in enlarged growth. *Ypsilospora tucumanensis* J.R. Hern. & J.F. Hennen on *Inga edulis* is described as a species new to science. *Puccinia cordiae* Arthur is cited as a new record for Argentina. These rusts also are included: *Chaconia ingae*, *Gerwasia imperialis*, *Kuehneola loeseneriana*, *Prospodium appendiculatum*, *Prospodium elegans*, *Prospodium perornatum*, *Puccinia bougainvilleae*, *Puccinia pampeana*, *Ravenelia argentinica*, *Ravenelia hieronymi*, *Ravenelia papillosa*, *Ravenelia spegazziniana*, *Uromyces cestri* and *Uropyxis rickiana*. For some of the scientific names, lectotype specimens have been designated.

***Key words:*** morphology, nomenclature, South America, Uredinales, *Ypsilospora*

## INTRODUCTION

The fungi of Argentina have been studied by a number of mycologists, most notably Carlos Spegazzini, who collected extensively in South America in the latter part of the 19th century and first half of the 20th century. He made a number of collecting trips to northwestern Argentina. Spegazzini's collections of rust fungi from the entire country were organized and studied by Juan C. Lindquist. Lindquist's study resulted in numerous publications on rust fungi, culminating in "Royas de la República Argentina y Zonas Limítrofes" (Lindquist 1982), which remains the most comprehensive work on the rust fungi of Argentina.

Northwestern Argentina, which includes the provinces of Catamarca, Jujuy, Salta and Tucumán, is a subtropical area characterized by great climatic and biological diversity. The region consists of plains in the east and the Cordillera de los Andes, which has alternating valleys and mountains within short distances, in the west. These gradations in latitude and altitude result in intermingling ecological zones with vegetation types that range from desert to rain forest (Cabrera 1994).

Although Argentina has been relatively well studied mycologically, northwestern Argentina is less studied compared to other regions, especially southern Argentina. This fact, plus the high level of biodiversity in the region, make this an interesting and rich area for study. Lindquist (1982) documented 450 species, representing 28 genera of rust fungi from throughout Argentina of which 124 species were reported from northwestern Argentina. Between 1993 and 1999 the authors collected 635 specimens of rust fungi in northwestern Argentina representing 182 species in 30 genera. Ten new species were discovered and 61 rusts were cited for the first time in Argentina (Hernández and Hennen 2002a).

Among the fungi frequently encountered in northwestern Argentina are rust infections that cause conspicuous galls, witches' brooms and other abnormal growths. Such abnormal growths appear to be more common in ecologically diverse northwestern Argentina than in tropical regions of South America. Northwestern Argentina is a climatic transition zone, and many of the woody plants are deciduous.

Galls, witches' brooms and other abnormal growths are produced as a result of parasitic organisms and other agents that stimulate the plant to produce these tissues. Fungi, bacteria, nematodes, insects, eriophyid mites, phytoplasmas, viruses and other organisms cause abnormal growths (Williams 1994), as can abiotic agents such as radiation and herbicides. These malformations usually are a result of hypertrophy, hyperplasia or hypoplasia (Lindquist 1982, Preece and Hick in Williams 1994).

Various kinds of fungi cause abnormal plant growths. Among these are ascomycetes, such as *Taph-*

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*rina deformans*, causing blight or leaf curl on *Prunus domestica* (Booth 1981), and members of the Cyttariales that produce tumors on species of *Nothofagus* (Gamundi 1991, Korf 1983). Some basidiomycetes produce abnormal growths; for example, *Crinipellis perniciosa*, which produces witches' broom on cacao ("krulloten") resulting in an economically important disease that limits production of this crop in Brazil and other parts of the world (Purdy and Schmidt 1996). Species of *Exobasidium* cause leaf malformations of *Rhododendron* (Nannfeldt 1967).

Rust fungi are well known for causing abnormal growths, including galls, witches' brooms and other plant malformations (TABLE I). The ability of rust fungi to cause locally systemic infections in the abnormal growths of these deciduous plants might have developed as a survival mechanism. In addition, these abnormal growths provide an increased surface area for sporulation. Two of the most common forms of abnormal growths encountered in Argentina are galls and witches' brooms. For example, in southern Argentina and Chile, witches' brooms caused by *Aecidium magellanicum* frequently are encountered on *Berberis buxifolia* (Lindquist 1982, Mujica and Oehrens 1967). The aecial state of *Puccinia menthae* produces abnormal growths on species of *Mentha* (Lindquist 1982). Large galls can be seen from a distance on the Argentinean national tree, *Erythrina crista-galli*, resulting from infections by *Ravenelia platensis* (Lindquist 1982).

Galls, sometimes referred to as mycocecidia (Kirk et al 2001) or tumors (Lindquist 1982), are swollen, circumscribed areas of various plant organs with fusiform, globoid, lobed or other atypical shapes (e.g., in FIG. 42). Usually they are formed as a specific reaction of the plant in which the gall-inducing organism is isolated in space and time (Mani 1964). Galls form on annual and perennial plants, both herbaceous and are woody. Witches' brooms are closely spaced vertical shoots bearing reduced leaves (e.g., in FIG. 61) that might be caused by fungal infections of growing points (Meyer 1987). In this case, rust fungi penetrate the meristematic tissues, such as buds, and induce an active development of supernumerary buds forming somewhat compact masses of different shapes, sizes and colors. On herbaceous, succulent hosts, such as some solanaceous plants, buds are distorted and become thickened. Infection of *Solanum* sp. by *Puccinia pampeana* results in a curling and distortion of the buds (FIGS. 58, 59). On woody shrubs, such as *Tecoma garrocha* (Bignoniaceae) infected by *Prospodium elegans*, bud infection produces elongate, curvilinear distortions hanging from the branches (FIG. 11).

Flower infections often result in distortions of young pods of Fabaceae and young capsules of Bignoniaceae. In northwestern Argentina, symptoms on species of *Acacia* (Mimosoideae) often are spidery, resulting from elongate growths from a cluster of pods (FIGS. 61, 62). Stands of heavily infected plants, such as the shrubby, bignoniaceous *Tecoma stans* infected by *Prospodium appendiculatum*, often acquire the cinnamon-brown color of the spore-laden galls.

Plants infected by *Uromyces cestri* and *Prospodium perornatum* have distorted leaves, petioles, pods and flowers, which are the result of the confluence of many small, hypertrophied spots where individual sori were produced. These two species do not cause galls and witches' brooms, as do other species treated in this paper, but numerous local infections cause distortions that give the plants an abnormal look.

In this paper, we treat 16 species of rust fungi, most of which produce abnormal growths, collected in northwestern Argentina. A new species is described, along with a new record for Argentina and several newly discovered states. For each species, we provide complete nomenclators, detailed descriptions and illustrations. The anamorph name and synonyms are provided, following the list of teleomorph synonyms. If no appropriate anamorph name is available, a generic anamorph name followed by "sp." is provided.

## MATERIALS AND METHODS

Field collections were made in northwestern Argentina in the provinces of Catamarca, Jujuy, Salta and Tucumán. Specimens have been deposited in the U.S. National Fungus Collection (BPI) and at Instituto Miguel Lillo, Tucumán, Argentina (LIL). In addition to studying field collections, specimens from BPI, Arthur Herbarium (PUR), and Instituto Spegazzini (LPS) were examined. Material was prepared for microscopy by placing freehand sections of sori or scrape mounts of spores in lactophenol. They were examined with transmitted light, phase contrast, differential interference microscopy or scanning electron mycroscopy (SEM). Chloral hydrate was used to clear some heavily pigmented structures and cotton blue was used to stain hyaline structures.

For the specimens examined, we detail the different states encountered in each specimen as follows: 0 (spermogonial state), I (aecial state), II (uredinial state) and III (telial state).

The information on host and distribution outside Argentina comes from various sources, including *Royas de la República Argentina y Zonas Limítrofes* (Lindquist 1982), the databases of the U.S.D.A./A.R.S. Systematic Botany and Mycology Laboratory (http://nt.ars-grin.gov), *Índice das Ferrugens (Uredinales) do Brasil* (Hennen et al 1982), and *Uredinales (Royas) de Mexico* (Gallegos and Cummins 1981).

Plant host names cited in Hosts and Distribution were updated, as needed, with w$^3$Tropicos (http://mobot.mobot.org/W3T/Search/vast.html).

TABLE I. Genera of rust fungi that produce galls, witches' brooms and other abnormal growths

***Aecidium*** Pers., e.g., *Aecidium magellanicum* Berk. (0-I) causing witches' brooms on *Berberis buxifolia* Lam. (Lindquist 1982).

***Atelocauda*** Arthur & Cummins, e.g., *Atelocauda digitata* (G. Winter) Cummins & Y. Hirats. (0-I) causing witches' brooms on *Acacia koa* var. *latifolia* (Benth.) H. St. John (Hodges and Gardner 1984, Cummins & Hiratsuka 1983)

***Caeoma*** Link, e.g., *Caeoma* sp., aecial state of *Ravenelia argentinica* J.R. Hern. & J.F. Hennen (I) causing witches' brooms on *Acacia aroma* Gilles in Hooker (Hernández and Hennen 2002b).

***Cerotelium*** Arthur, e.g., *Cerotelium dicentrae* (Trel.) Mains & H.W. Ander. (0-I) causing abnormal growths on *Dicentra cucullaria* (L.) Bernh (Cummins and Hiratsuka 1983).

***Chrysomyxa*** Unger, e.g., *Chrysomyxa arctostaphyli* Dietel (anamorph *Peridermium coloradense* (Dietel) Arthur & F. Kern) (I) causing witches' brooms on *Tsuga* spp. (Ziller 1974).

***Coleosporium*** Lév., e.g., *Coleosporium tussilaginis* (Pers.) Lév. (I) causing galls on *Pinus silvestris* L. (Preece and Hick in Williams 1994).

***Cronartium*** E. Fries, e.g., *Cronartium* spp. (0-I), causing hypertrophy on stems and cones of *Pinus* spp. (Ziller 1974).

***Cumminsiella*** Arthur, e.g., *Cumminsiella mirabilissima* (Peck) Nannf. (I) causing galls on *Mahonia* spp. (Preece and Hick in Williams 1994).

***Endocronartium*** Y. Hiratsuka, causing galls on *Pinus* sp. (Ziller 1974).

***Endophyllum*** Lév., e.g., *Endophyllum euphorbiae-silvaticae* (DC) Winter (III) causing galls on *Euphorbia amygdaloides* L. (Preece and Hick in Williams 1994).

***Endoraecium*** Hodges & D.E. Gardner, e.g., *Endoraecium acaciae* Hodges & D.E. Gardner (I-III) causing witches' brooms on *Acacia koa* A. Gray var. *koa* (Hodges and Gardner 1984).

***Gymnoconia*** Lagerh., e.g., *Gymnoconia nitens* (Schwein.) F. Kern & H.W. Thurston (III) causing galls on *Rubus* spp. and studied as a potential biological control agent (Gardner et al 1997).

***Gymnosporangium*** R. Hedw. ex DC. in Lam. & DC. (III) causing witches' brooms on gymnosperms (Parmelee 1971).

***Haplophragmidium*** Syd. (III) causing galls on leaves and branches of *Acacia* spp. (Lohsomboon et al 1992).

***Kuehneola*** Magnus, e.g., *Kuehneola loeseneriana* (Arthur) Jackson & Holway in Jackson (0-I) causing galls on *Rubus* spp. (this paper).

***Melampsora*** Castagne, *Melampsora epitea* Thümen (I) causing galls on *Dactylorchis* spp. (Preece and Hick in Williams 1994).

***Melampsorella*** Schroet., e.g., *Melampsorella caryophyllacearum* Schroet. (0-I) causing witches' brooms on *Abies* (Hama 1984).

***Nyssopsora*** Arthur, e.g., *Nyssopsora echinata* (Lév.) Arthur (III) causing galls on *Meum athamanticum* Jacq. (Preece and Hick in Williams 1994).

***Ochrospora*** Dietel, e.g., *Ochrospora ariae* (Fckl.) Ramsb. (I) causing galls on *Anemone nemorosa* L. (Preece and Hick in Williams 1994).

***Peridermium*** (Link) J.C. Schmidt & Kunze (0-I) causing galls and witches' brooms on gymnosperms (Dix et al 1996).

***Phragmidium*** Link., e.g., *Phragmidium mucronatum* (Pers.) Schlecht. (I) causing galls on *Rosa* spp. (Preece and Hick 1990).

***Pileolaria*** Castagne, e.g., *Pileolaria effusa* Peck. (0-I) causing abnormal growth on *Rhus* sp. (Gallegos and Cummins 1981).

***Puccinia*** Pers., e.g., *Puccinia pampeana* Speg., abnormal growth of *Salpichroa origanifolia* (this paper); *Puccinia menthae* Pers., e.g., (I) causing distortion and swelling of stems of *Mentha* spp. (Lindquist 1982).

***Pucciniastrum*** G.H. Otth, e.g., *Pucciniastrum goeppertianum* (Kuehn) Kleb. (III) causing witches' brooms on *Abies* (Gallegos and Cummins 1981).

***Ravenelia*** Berk., e.g., *R. prosopidiicola* J.C. Lindq. (0-I) causing galls on *Prosopis* sp. (Hernández and Hennen 2002b).

***Tranzschelia*** Arthur, e.g., *Tranzschelia discolor* (Fuckel) Tranzschel & Litvinov (0-I) causing hypertrophy of leaves of *Anemone* spp. (López-Franco and Hennen 1990).

***Triphragmiun*** Link in Wild., e.g., *Triphragmium filipendulae* (Lasch) Passerini (I) causing distortions of host organs (Lohsomboon et al 1990).

***Uromycladium*** McAlp., e.g., *Uromycladium tepperianum* (Sacc.) McAlpine (III) causing galls on *Acacia saligna* Lindl. (Morris 1977).

***Uromyces*** (Link) Unger, e.g., *Uromyces cestri* Montagne in Gray (II) causing hypertrophied spots on *Cestrum* spp. (this paper); *Uromyces novissimus* Speg. (II) causing galls to 20 cm diam on Cucurbitaceae (Lindquist 1982).

***Uropyxis*** J. Schroet., e.g., *Uropyxis rickiana* P. Magnus (II-III) causing galls on *Macfadyena unguis-cati* (L.) Gentry (this paper).

***Ypsilospora*** Cumm., e.g., *Ypsilospora tucumanensis* J.R. Hern. & J.F. Hennen (I) causing abnormal growth on *Inga edulis* Martius (this paper).

***Zaghouania*** Pat., e.g., *Zaghouania phillyreae* Pat. (I) causing galls on *Phillyrea latifolia* L. (Preece and Hick in Williams 1994).

## TAXONOMY

Sixteen known species of rust fungi from northwestern Argentina cause a plant response that results in abnormal growth. Each species is described, illustrated and discussed, based on specimens examined as listed. In addition, the complete host and geographic range are given, based on the literature and specimens examined.

Two of the 16 species do not produce abnormal growths but are included because they could be confused with those that produce such growths on that same host. *Gerwasia imperialis* does not produce galls, but aecia frequently are encountered on leaves of species of *Rubus*. Aecia of *Kuehneola loeseneriana* are produced on galls on *Rubus* but also are produced on leaf spots and therefore could be confused macroscopically with those of *G. imperialis*. *Chaconia ingae* does not produce abnormal plant growths on *Inga edulis* but is included to clarify the differences between this species and the newly described *Ypsilospora tucumanensis* on the same host. The anamorphs of *C. ingae* and *Y. tucumanensis* have been confused in the past.

***Chaconia ingae*** (Syd.) Cummins, Mycologia 48: 602. 1956. FIGS. 1–3

≡ *Maravalia ingae* Syd., Mycologia 17: 257. 1925.
≡ *Bitzea ingae* (Syd.) Mains, Mycologia 31: 38. 1939.
= *Maravalia urticulata* Syd., Ann. Mycol. 23: 314. 1925.

*Anamorph*. ***Uredo excipulata*** Syd. & P. Syd., Ann. Mycol. 2: 350. 1904.

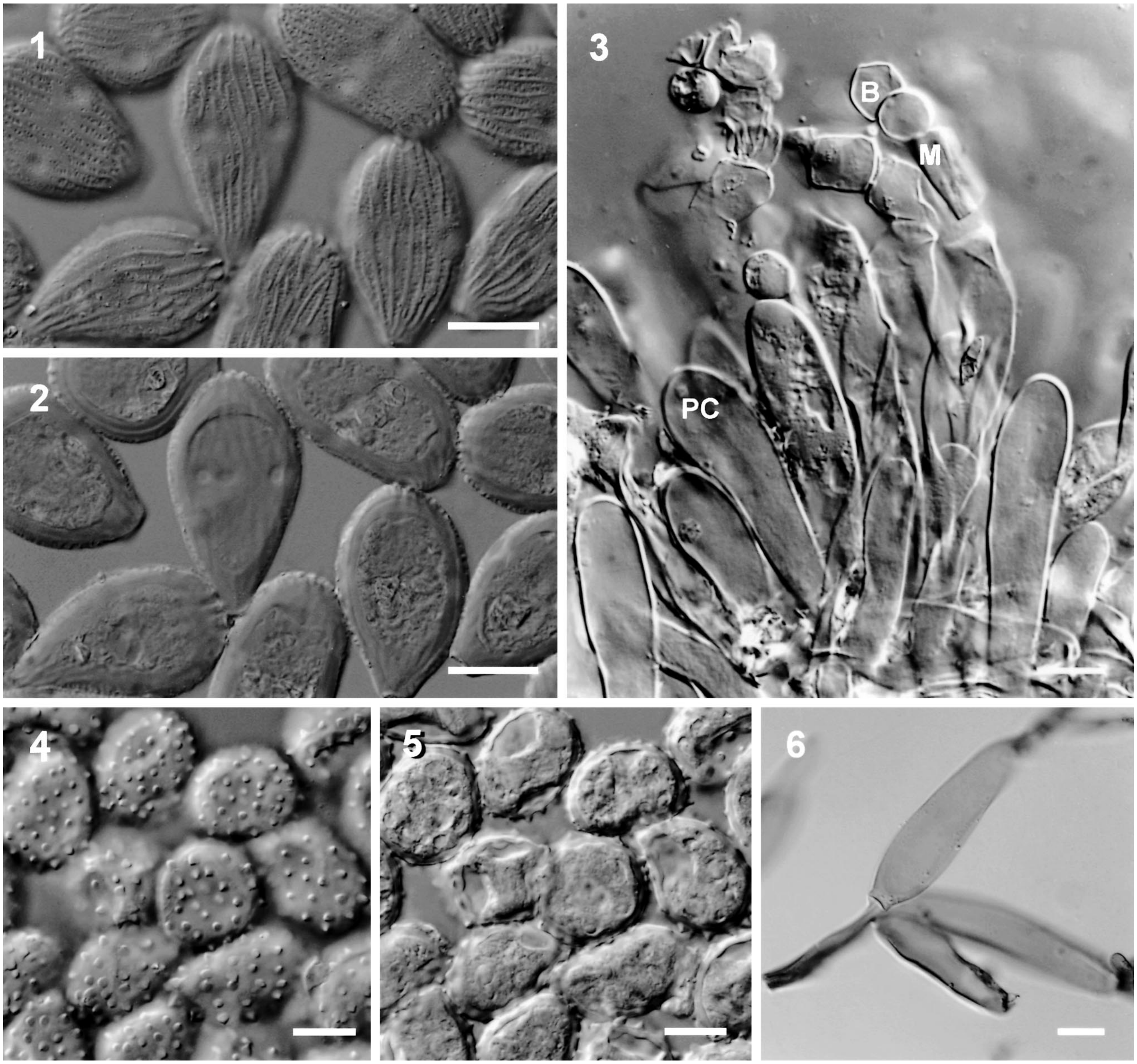
= *Uromyces ingicola* Henn., Hedwigia 43: 157. 1904 (urediniospores misidentified as teliospores).
= *Uromyces ingicola* Henn., Hedwigia 48: 1. 1908, hom. illeg.
= *Uromyces porcensis* Mayor, Mém. Soc. Sci. Nat. Neuchâtel. 5: 459. 1913 (urediniospores misidentified as teliospores).
= *Ravenelia whetzelii* Arthur, Mycologia 9: 64. 1917 (only spermogonia and aecia described).
= *Uromyces ingaeiphilus* Speg., Revista Argent. Bot. 1(2a.–3a.): 140. 1925 (urediniospores misidentified as teliospores).
= *Uredo mogy-mirim* Viégas, Bragantia 5: 85. 1945.
[*Uromyces ingae* Lagerh. in Arthur, Mycologia 9: 65. 1917. *nom. nud.*]

Spermogonia amphigenous, subcuticular in origin, lenticular to hemispherical, 100–200 × 24–35 μm. Aecia amphigenous, subepidermal in origin, deep-seated in host mesophyll tissues, erumpent; aeciospores pedicellate, obovoid to ellipsoid, short clavate or irregular, attenuate toward base, (20–) 24–48 (–55) × 14–26 (–30) μm, walls 2–4 μm thick at sides, 2–5 μm thick at apex, 3–9 μm thick at base, cinnamon brown, with prominent longitudinal ridges (verrucae in lines), often reticulate with less pronounced cross ridges, germ pores 3–4, equatorial. Uredinia and urediniospores similar to aecia and aeciospores, respectively. Telia hypophyllous, scattered or loosely gregarious, often confluent, subepidermal in origin, early erumpent; teliospores 1-celled, laterally free, clavate to cylindrical, sessile and grouped on sporogenous basal cells, 70–140 × 12–20 μm, wall thin, hyaline, germ pore not differentiated, germination without dormancy, metabasidia formed by apical elongation of probasidia; basidiospores obovoid, 9–10 × 7–8 μm.

*Hosts and distribution.*—*Inga adenophylla* Pittier, Colombia; *Inga affinis* DC., Paraguay; *Inga coriacea* var. *leptopus* (Benth.) J.F. Macbr., Costa Rica; *Inga edulis* Mart., Argentina, Belize, Brazil, Colombia, El Salvador, Guatemala; *Inga fagifolia* G. Don, Puerto Rico, Virgin Islands; *Inga fastuosa* (Jacq.) Willd., Venezuela; *Inga holtonii* Pittier, Colombia; *Inga huberi* Ducke, Ecuador; *Inga inga* (Vell.) J. Moore, Puerto Rico; *Inga ingoides* (Rich.) Willd., Colombia; *Inga inicuil* Cham. & Schltdl., Mexico; *Inga insignis* Kunth, Brazil, Ecuador; *Inga laurina* (Sw.) Willd., Puerto Rico; *Inga leptopus* Benth. (originally cited erroneously as *I. leptopoda* Benth. on Holway's labels), Costa Rica; *Inga micheliana* Harms, Guatemala; *Inga pachycarpa* Benth., Ecuador; *Inga preussii* Harms, Argentina, El Salvador; *Inga pinetorum* Pittier, Belize, Honduras; *Inga preussii* Harms, El Salvador; *Inga ruiziana* G. Don, Panama; *Inga sessilis* (Vell.) Mart., Brazil; *Inga spuria* Hum. & Bonpl. ex Willd., Colombia, Ecuador, Guatemala; *Inga vera* Willd., Brazil, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Guyana, Mexico, Panama, Puerto Rico, Venezuela, Virgin Islands; *Inga* sp., Brazil, Colombia, Costa Rica, Ecuador, El Salvados, Guyana, Mexico, Peru, South America, Trinidad and Tobago, Venezuela, West Indies.

*Specimens examined.*—BRAZIL. Alto da Serra. On *Inga* sp., 14 Jun 1922, *E.W.D. Holway & M.M. Holway 1968* (BPI 18883) [II]. GUYANA. Vreed en Hoop. On *Inga* sp., 1 Aug 1922, *F.L. Stevens 715* (BPI 143227 LECTOTYPE, herein designated; BPI 18887, ISOLECTOTYPE of *Chaconia ingae*) [III]. ECUADOR. Quito, Valle Chiche. On *I. insignis*, 3 Sep 1920, *E.W.D. Holway & M.M. Holway 962* (BPI 18894) [II]. On *Inga* sp., 9 Mar 1969, *E.Y. Okasako* (BPI 18891) [II]. On *Inga* sp., 1 Feb 1964, *R.E. Whitley* (BPI 18889) [II]. PUERTO RICO. Mayagüez, La Jagua. On *I. vera*, 28 Mar 1916, *H.H. Whetzel & E.W. Olive 206* (BPI 18898, BPI 19702, BPI 19695, BPI 150041, ISOTYPES of *Ravenelia whetzelii*) [II].

*Commentary.*—Sydow (1925) described only the telial state when he established *Maravalia ingae*, the bas-




FIGS. 1–6. *Chaconia ingae* and *Gerwasia imperialis*. 1. Surface view of urediniospores of *C. ingae*, 2. Median view of 1, 3. Teliospores of *C. ingae*: probasidial cells (PC), metabasidia (M), and basidiospores (B), 4. Surface view of urediniospores of *G. imperialis*, 5. Median view of 4, 6. Pedicillate teliospore of *G. imperialis* with probasidial cells. Bars = 13.3 μm.

ionym for this species. Mains (1939a) connected spermogonial, aecial, uredinial and telial states. Many names have been applied to *Chaconia ingae*, and the extensive synonymy has been reviewed by Mains (1939a) and Ono and Hennen (1983). Much of the confusion was a result of the morphological characters of the anamorphs of *C. ingae*. The aecio- and urediniospores of this species are striate and apiculate and, for this reason, many mycologists incorrectly considered them to be teliospores, describing these anamorphs in genera such as *Uromyces*. Because the anamorph spores are similar to those produced by some species of *Ravenelia*, Arthur (1917) described this rust as *Ravenelia whetzelii*, although he never observed teliospores.

*Chaconia ingae* has been confused with another rust fungus on *Inga*. Echinulate urediniospores often are observed in sori on leaves of *Inga edulis* and were thought by some to be secondary urediniospores of *C. ingae*. Arthur (1907) described them as *Ravenelia ingae*. Mains (1939a) and Lindquist (1940) indicated that this anamorph, *Uredo ingae* Henn., was a different species, and we consider it to belong to a new species of *Ypsilospora* described in this paper.

***Gerwasia imperialis*** (Speg.) J.C. Lindq., Revista Fac. Agron. Univ. Nac. La Plata 38: 83. 1962. FIGS. 4–7
≡ *Uredo imperialis* Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 6: 241. 1898 (Spegazzini described teliospores, not urediniospores).
≡ *Mainsia imperialis* (Speg.) J.C. Lindq., Notas Mus. La Plata Bot. IV (23): 166. 1939.
= *Mainsia holwayii* H.S. Jacks., Mycologia 23: 109. 1931.

Spermogonia epiphyllous, in lenticular cavities, subcuticular in origin, visible on hypertrophied epidermal cells, 115 × 70 μm. Aecia epiphyllous, intraepidermal, usually in circles surrounding spermogonia, yellowish-orange, without paraphyses or peridia; aeciospores ellipsoidal or obovate, 23–28 × 17–21 μm, wall hyaline, thin, 1–2 μm thick, 3–5 μm at apex, prominently and sparsely echinulate, most numerous on upper part of spore, pores not seen. Uredinia hypophyllous, suprastomatal, without paraphyses, yellowish; urediniospores similar to aeciospores but smaller. Telia hypophyllous, suprastomatal, scattered or aggregated, yellowish, compact; teliospores clavate, 50–65 × 15–17 μm, wall thin, hyaline, 1–1.5 μm thick, unthickened above, pedicel short; germination without dormancy.

*Hosts and distribution.*—*Rubus boliviensis* Focke, Argentina; *Rubus imperialis* Cham. & Schltdl., Argentina; *Rubus floribundus* Weihe, Bolivia; *Rubus urticaefolius* Poir., Peru; *Rubus* sp., Bolivia.

*Specimens examined.*—ARGENTINA. SALTA: "camino de corniza" between Salta and Jujuy. On *R. imperialis*, 7 Dec 1997, *J.R. Hernández 97–174* (BPI 841926) [0-I]. Dept. Santa Victoria, Los Toldos, El Nogalal. On *R. imperialis*, 29 Jun 1996, *J.R. Hernández 96–045* (BPI 841924) [0-I-II- III]. *J.R. Hernández 96–046* (BPI 841922) [0-I-III]. TUCUMÁN: Horco Molle, Parque Sierras de San Javier. On *R. boliviensis*, 6 Apr 1994, *J.F. Hennen, M.M. Hennen & J.R. Hernández 94–085* (LIL 54902, BPI 841923) [I- III]. San Javier, Parque Sierras de San Javier. On *R. boliviensis*, 27 Mar 1993, *J.F. Hennen, L.D. Ploper & J.R. Hernández 93–030A* (LIL 54903, BPI 840998B) [0-I]. *J.F. Hennen, L.D. Ploper & J.R. Hernández 93–026* (BPI) [0-I- III]. *J.F. Hennen, L.D. Ploper & J.R. Hernández 93–037* (LIL 54901, BPI) [I]. El Siambón, river next to monastery. On *R. imperialis*, 3 Nov 1997, *J.R. Hernández 97–146* (BPI 841244) [0-I]. Horco Molle. On *R. imperialis*, 14 Nov 1997, *J.R. Hernández 97–138* (BPI 841925) [0-I-III].

*Commentary.*—Spegazzini (1898) described teliospores in the original description of *Uredo imperialis*, although he referred to them as urediniospores. Lindquist (1939) transferred the epithet to *Mainsia* and wrote that he could not observe uredinia. Lindquist later (1962) transferred this name to *Gerwasia*, describing spermogonia, primary uredinia (aecia) and telia.

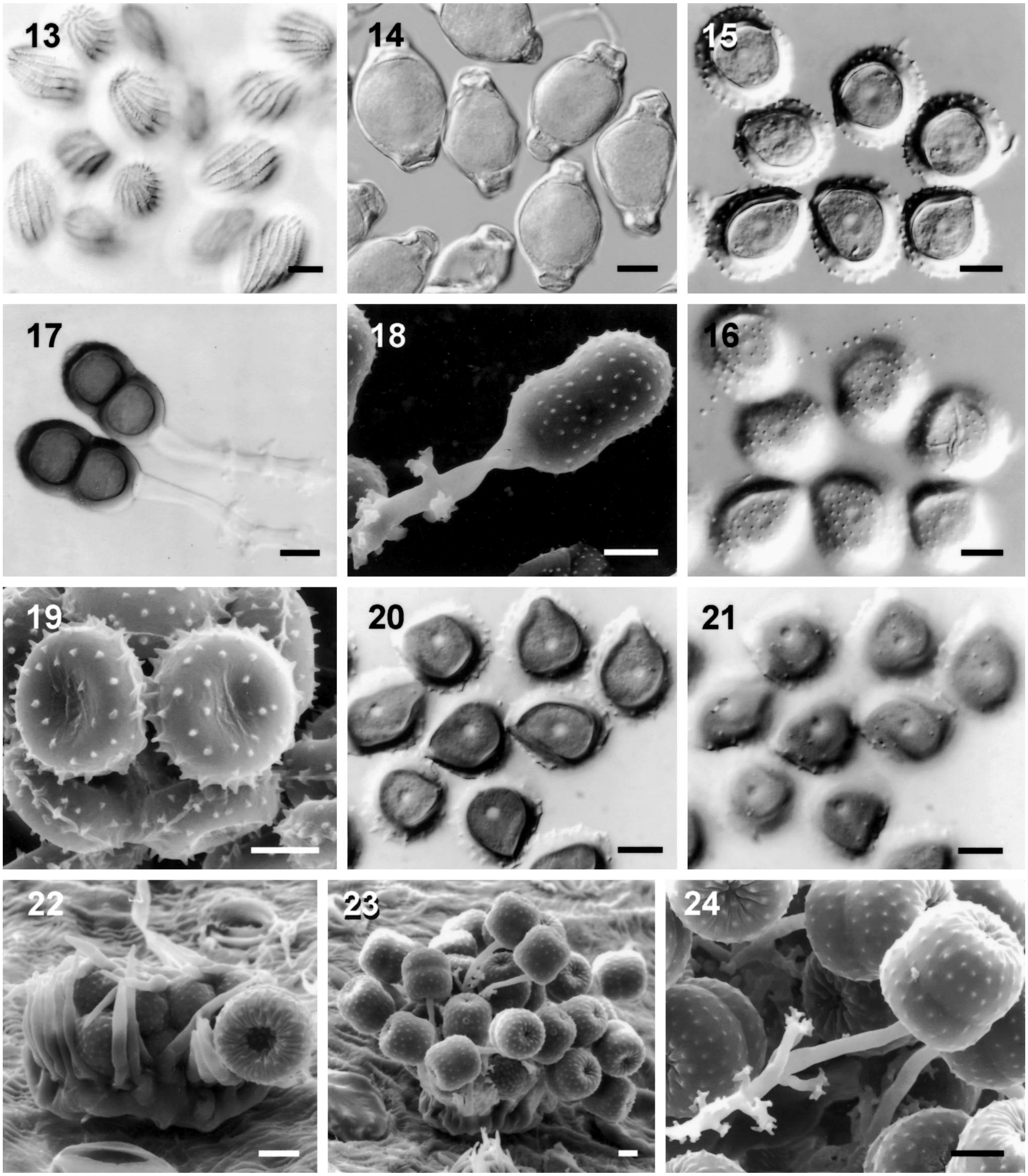
*Gerwasia imperialis* is a macrocyclic rust with spermogonia, aecia, uredinia and telia. In previous descriptions, uredinia were not reported or aecia were mistaken for uredinia. For example, Jackson (1931) described spermogonia, uredinia and telia for *Mainsia holwayii* but, according to the ontogenic concept of life cycle terminology, the uredinia and urediniospores that Jackson described actually are aecia and aeciospores because the sori surround the spermogonia and are epiphyllous. In this paper, we describe for the first time the uredinia and urediniospores of *Gerwasia imperialis* (collection *J.R. Hernández 96–045* (BPI 841924) [0-I-II-III]).

***Kuehneola loeseneriana*** (Arthur) H.S. Jacks. & Holw. in H.S. Jacks. [as "(Henn.) H.S. Jacks. & Holw."], Mycologia 23: 105. 1931. FIGS. 8, 13, 14
≡ *Spirechina loeseneriana* Arthur [as "(Henn.) Arthur, *nom. nov.*"], J. Mycol. 13: 30. 1907.
≡ *Uromyces loesenerianus* (Arthur) P. Syd. & Syd. [as "(Henn.) Syd."], Monog. Ured. 2: 202. 1910.
= *Uromyces arthuri* P. Syd. & Syd., Monog. Ured. 2: 203. 1910.
≡ *Spirechina arthuri* (P. Syd. & Syd.) Arthur, N. Am. Fl. 7(3): 183. 1912.
≡ *Kuehneola arthuri* (P. Syd. & Syd.) H.S. Jacks., Mycologia 23: 106. 1931.
= *Kuehneola uleana* Syd. & P. Syd., Ann. Mycol. 14: 258. 1916.

*Anamorph.* ***Uredo loeseneriana*** Henn., Hedwigia 37: 273. 1898.
= *Uredo imperialis* f. *ramulicola* Speg., Anales Soc. Ci. Argent. 47: 276. 1899.
= *Uromyces usterii* Speg., Revista Mus. La Plata, Secc. Bot. 15: 7. 1908 (Spegazzini described the uredinial state, not the telial state).

Spermogonia on branch galls or on swollen leaf veins, brownish to amber, intraepidermal, hymenium flat to slightly concave; growth indeterminate; group 4 (Hiratsuka and Hiratsuka 1980). Aecia on abnormal growths on leaves, petioles, and stems, forming galls up to 5 cm diam or more, often branches deformed or veins swollen, yellowish-orange, powdery, subepidermal in origin, ruptured epidermis evident, scattered, pulverulent, often covering the whole surface of galls, soon exposed, surrounded by the ruptured epidermis; on the stems subcortical, linear or narrowly oblong, up to 1 cm long, 1–1.5 mm wide, opening by a longitudinal, median rupture; on the petioles similar to those on stems but smaller; on leaves in bright golden-yellow spots 0.1–2 mm diam;


FIGS. 7–12. *Gerwasia imperialis*, *Kuehneola* sp., *Prospodium appendiculatum*, and *Prospodium elegans*. 7. Aecia of *G. imperialis* on leaflet of *Rubus* sp., 8. Aecial galls of *Kuehneola* sp. on stems of *Rubus* sp., 9. Aecial galls of *P. appendiculatum* on leaflet and capsules of *Tecoma stans*, 10. Telia of *P. appendiculatum* on leaflets of *T. stans*, 11. Abnormal growth of *T. garrocha* caused by *P. elegans*, 12. Abnormal growth on young branch of *T. garrocha* caused by *P. elegans*.




FIGS. 13–24. *Kuehneola loeseneriana*, *Prospodium appendiculatum*, *Prospodium perornatum*. 13. Surface view of urediniospores of *K. loeseneriana*, 14. Teliospores of *K. loeseneriana*, 15. Median view of urediniospores of *P. appendiculatum*, 16. Surface view of 15, 17. Teliospores of *P. appendiculatum* showing ornamented pedicel, 18. Scanning electron micrograph (SEM) of teliospores of *P. appendiculatum*, 19. SEM of aeciospores of *P. perornatum*, 20. Median view of aeciospores of *P. perornatum*, 21. Surface view of 20, 22. SEM of young telium of *P. perornatum*, 23. SEM of telium with mature teliospores of *P. perornatum*, 24. SEM of teliospore of *P. perornatum* showing whorls of appendages on pedicel. Bars = 10 μm.

aeciospores pedicellate, pale-yellow, ellipsoid, globose, or oblong-ellipsoid, (20–) 28–40 (–42) × (16–) 18–24 (–25) μm, wall nearly hyaline, 1–2.5 (–3) μm thick, (2–) 4–7 μm at apex, finely and closely verrucose, verrucae arranged in curved lines from one end of the spore to the other, forming spiral striations along the length of the spore, pores 2, obscure. Uredinia hypophyllous, whitish to yellowish, round, subepidermal; urediniospores similar to aeciospores. Telia hypophyllous, white, subepidermal in origin, erumpent, scattered, isolated or aggregated, aparaphysate; teliospores pedicellate, in clavate or elongate-cuneate chains of 2–4 probasidial cells, oblong or ellipsoid, upper part ending in digital or crown-like projections or attenuate or flat, each cell 24–60 × 17–24 μm, wall 1.5–2 μm on sides, 5–7 (–15) μm at apex, hyaline to yellowish, smooth, germ pores obscure but germination without dormancy, germ tube emerging from apical corners; pedicel thick, as long as a probasidial cell.

*Hosts and distribution.*—*Rubus amplior* Rydb., Guatemala; *Rubus bogotensis* Kunth, Bolivia, Ecuador; *Rubus boliviensis* Focke, Argentina; *Rubus brasiliensis* Mart., Brazil; *Rubus erythroclados* Mart., Brazil; *Rubus floribundus* Weihe, Bolivia; *Rubus guyanensis* Focke, Guatemala; *Rubus humistratus* Steud., Mexico; *Rubus imperialis* Cham. & Schltdl., Argentina; *Rubus schiedeanus* Steud., Guatemala; *Rubus sellowii* Cham. & Schltdl., Brazil; *Rubus trichomallus* Schltdl., Costa Rica; *Rubus urticaefolius* Focke, Brazil; *Rubus urticifolius* Poir., Colombia; *Rubus* sp., Bolivia, Brazil, Costa Rica, Guatemala, Mexico, Peru.

*Specimens examined.*—ARGENTINA. TUCUMÁN: San Javier, Parque Sierras de San Javier. On *R. boliviensis*, 27 Mar 1993, *J.F. Hennen, L.D. Ploper & J.R. Hernández 93–030* (LIL 54900, BPI 840998A) [0-I-II-III]. BRAZIL. Rio de Janeiro, Therezopolis. On *Rubus* sp., 29 Sep 1921, *E.W.E & M.M. Holway s.n.* (BPI 141196) [I-II-III]. GUATEMALA. Cumbre de Aire. On *R. amplier*, 5 Dec 1936, *J.R. Johnston 432* (BPI 141154) [I-II-III]. (PUR 49432) [I-II-III]. Road from Quezaltenango to Columba. On *R. guyanensis*, 4 Feb 1917, *E.W.E. Holway 832* (BPI 141156) [I]. Depto. de Alta Verapaz, Coban. On *R. schiedeanus*, date?, *H.v. Tuerckheim s.n.* (PUR 8814 TYPE of *Uromyces arthuri*) [II-III].

*Commentary.*—*Kuehneola loeseneriana* is an example of a rust that is present on several species of one host genus (*Rubus* spp.) that grow under a variety of environmental conditions. The shape and dimensions of aecio- and urediniospores are variable, as are the shape, size and apical thickness of the teliospores, even within a single sorus. However, this species can be recognized by the characteristic spirally striate aeciospores and urediniospores.

Spermogonial and aecial infections cause leaf distortion and galls on stems, some of the latter 20 cm in length. Uredinia are produced in leaf spots, which, in northwestern Argentina, are macroscopically similar to aecia of *Gerwasia imperialis* (FIG. 7). The two species can be differentiated microscopically; urediniospores of *K. loeseneriana* are spirally striate whereas those of *G. imperialis* are sparsely echinulate.

Lindquist (1982) cited ''*Uromyces imperialis* f. *ramulicola* (Spegazzini 1913, p. 182)'' as a taxonomic synonym of *Kuehneola loeseneriana*. This reference should have been to *Uredo imperialis* f. *ramulicola* in Anales Soc. Ci. Argent. 47: 276. 1899, rather than to the *Uromyces*, and dated 1913.

Arthur (1907) established the genus *Spirechina* with *S. loeseneriana* as the type, describing the teliospores as 1-celled. Although Arthur (1907) described ''*S. loeseneriana* (P. Henn) Arthur *nom. nov.*'' based on *Uredo loeseneriana*, this actually is a new species because *U. loeseneriana* was based on an anamorph and he designated a new type specimen for *S. loeseneriana*. The epithet was transferred to *Kuehneola* because the teliospores are in chains (Jackson 1931).

Arthur (1907) described the aecia forming on galls as uredinia. Gallegos and Cummins (1981) were the first to report spermogonia. Uredinia were not reported previously for *Kuehneola loeseneriana* probably because teliospores develop quickly within the uredinia, making the latter difficult to observe.

Gallegos and Cummins (1981) considered *K. arthuri* distinct from *K. loeseneriana* because the teliospores of the former are irregularly lobed apically. We have observed that teliospores in collections from Central America more frequently are lobed than those from South America, but the number of lobes varies within a single telium. The aecial states of both produce similar abnormal growths and the aeciospores and urediniospores have the same distinctive ornamentation composed of verrucae forming spiral striations along the length of the spore. For these reasons *K. arthurii* is considered a synomym of *K. loeseneriana*.

***Prospodium appendiculatum*** (G. Winter) Arthur, J. Mycol. 13: 31.1907. FIGS. 9, 10, 15–18

≡ *Puccinia appendiculata* G. Winter, Flora 67: 262. 1884.

≡ *Dicaeoma appendiculata* (G. Winter) Kuntze, Revis. Gen. Pl. 3(2): 467. 1898.

= *Puccinia ornata* Harkn., Proc. Calif. Acad. Sci. II. 2: 231. 1889 [later homonym of *Puccinia ornata* Arthur & Holw. in Arthur (1887, p. 30), on *Rumex orbiculatus* A. Gray].

≡ *Puccinia medusaeoides* Arthur, Bot. Gaz. (Crawfordsville) 16: 226. 1891, *nom. nov.* for *Puccinia ornata* Harkn.

≡ *Dicaeoma stantis* Kuntze, Revis. Gen. Pl. 3(2): 467. 1898, *nom. nov.* for *Puccinia ornata* Harkn.

≡ *Puccinia tecomae* Sacc. & P. Syd. in Sacc., Syll. Fung. 14: 358. 1899, *nom. nov.* for *Puccinia ornata* Harkn.

*Anamorph.* ***Uredo cuticulosa*** Ellis & Everh., Bull. Lab. Nat. Hist. Iowa State Univ. 4: 67. 1896.

≡ *Puccinia cuticulosa* (Ellis & Everh.) Arthur, Mycologia 9: 83. 1917 (name based on an anamorph).

= *Uredo lilloi* Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 6: 234. 1898.

Spermogonia amphigenous and on stem and fruit galls. Aecia surrounding the spermogonia, on hypertrophied areas on leaflets, pods, flowers and branches, subepidermal in origin, cinnamon-brown, with peripheral paraphyses; aeciospores 24–34 × 21–26 μm, including outer wall, radially asymmetrical, unicapitate, mostly globoid, outer wall layer 5–9 μm thick, hyaline, uniformly echinulate, echinulae spaced 2–4 μm, inner wall 1.5–2 (–2.5) μm thick, golden or cinnamon-brown, pores 2, lateral, equatorial, in the flattened sides with only a thin layer of the outer wall except at apex and base. Uredinia hypophyllous, subepidermal in origin, erumpent, pulverulent, small, pale cinnamon-brown, with peripheral, incurved, short, hyaline paraphyses, 28–40 μm long, ventral wall 1 μm thick, dorsal wall 2.5–4 μm thick; urediniospores similar to aeciospores, (21–) 23–26 × (20–) 22–24 (–25) μm, outer wall (2.5–) 3–4 μm thick. Telia similar to uredinia, except blackish brown, sometimes developing in the uredinia, small, 0.1 mm diam; teliospores (40–) 43–53 (–57) × (23–) 25–30 (–32) μm, oblong ellipsoid, slightly constricted at septum, wall at sides (3–) 3.5–4.5 μm thick, 6–9 μm thick over pores, chestnut-brown, not laminate, echinulate with cones spaced (3–) 4–7 (–8) μm, pores apical in upper cell, next to pedicel in lower cell, each with a paler umbo; pedicel hyaline, thick-walled, mostly 60–90 μm long, with four or five conspicuous whorls of appendages with less-developed appendages below.

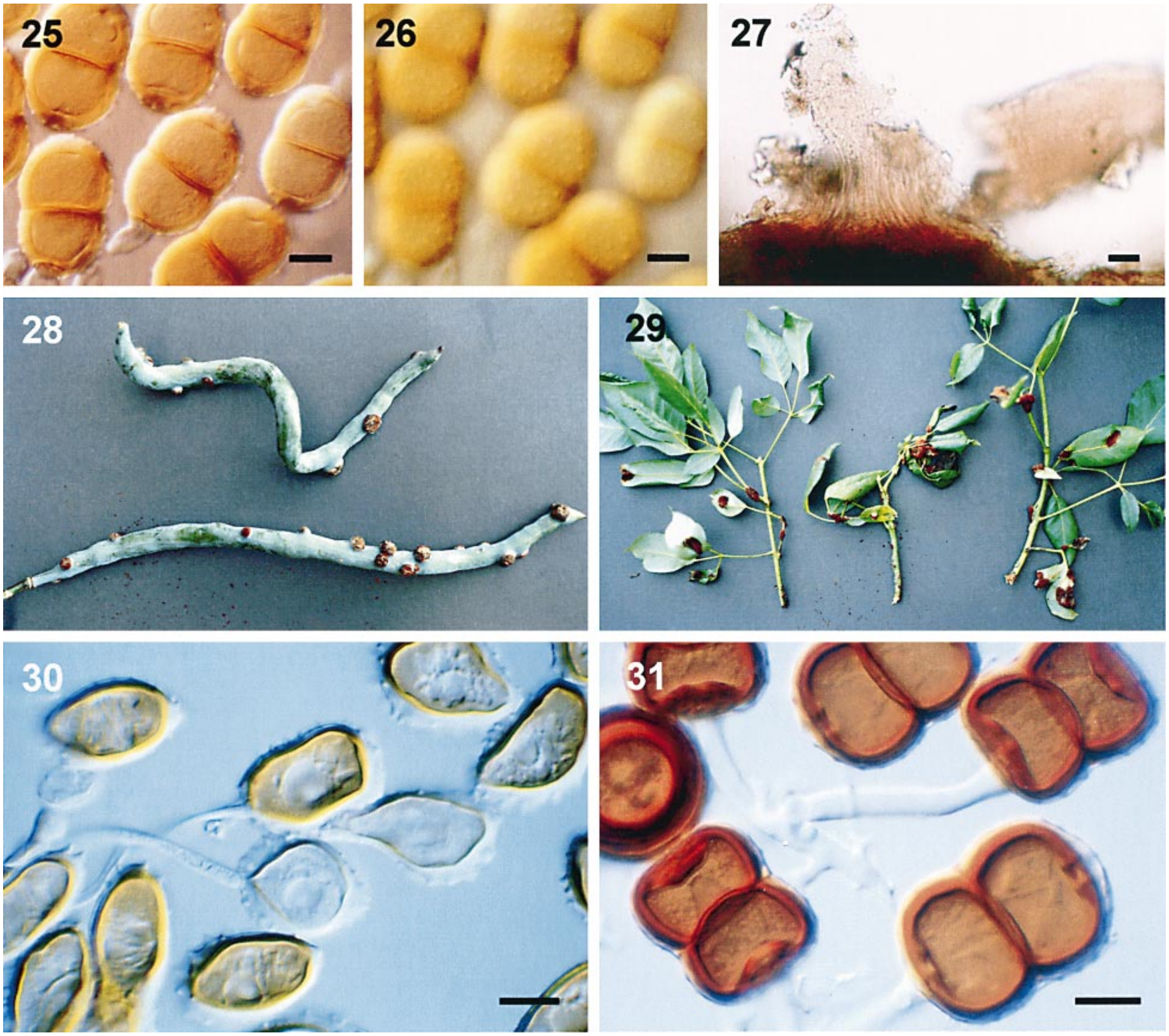
*Hosts and distribution.*—*Tecoma castanifolia* (D. Don) Melch. (= *Tecoma gaudichaudii* A. DC.), Ecuador; *Tecoma stans* (L.) Juss. ex Kunth in H.B.K. (= *Bignonia stans* L., = *Stenolobium stans* (L.) Seem., = *Stenolobium stans* var. *multijugum* R.E. Fr., = *Tecoma mollis* Kunth, = *Stenolobium molle* (Kunth) Seem.), Argentina, Antigua, Barbados, Bermuda, Brazil, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Jamaica, Martinique, Mexico, Nicaragua, Panama, Puerto Rico, Trinidad and Tobago, U.S.A., Venezuela, Virgin Islands; *Tecoma* sp. (= *Stenolobium* sp.), Brazil, Colombia, Costa Rica, Guatemala, Mexico, Nicaragua, Peru, U.S.A.; Bignoniaceae undtn., Brazil, Mexico, Nicaragua.

*Specimens examined.*—ARGENTINA. CATAMARCA: E of La Viña, Lat. S. 28° 03.735′, Long. W. 65° 35.324′. On *T. stans*, 24 Sep 1997, *J.F. Hennen & J.R. Hernández 97–060* (BPI 841929) [I]. JUJUY: Caimancito. On *T. stans*, 2 Apr 1993, *J.F. Hennen & L.D. Ploper 93–110* (LIL 54714, BPI) [I-II]. Parque Nacional Calilegua. On *T. stans*, 8 Dec 1997, *J.R. Hernández 97–180* (BPI 841268) [I]. Santa Clara. On *T. stans*, 12 Apr 1994, *J.F. Hennen & L.D. Ploper 94–131* (LIL 54716, BPI 841927) [II]. SALTA: Dept. Santa Victoria, La Misión. On *T. stans*, 30 Jun 1996, *J.R. Hernández 96–055* (BPI 841141) [II-III]. General San Martín. On *T. stans*, 7 Dec 1997, *J.R. Hernández 97–172* (BPI 841262) [I]. TUCUMÁN: Horco Molle. On *T. stans*, 15 Nov 1995, *J.R. Hernández 95–090* (BPI 841928) [I]. Horco Molle. On *T. stans*, 14 Nov 1997, *J.R. Hernández 97–132* (BPI 841930) [I]. Horco Molle. On *T. stans*, 31 Aug 2001, *J.R. Hernández 01–011* (BPI 841772) [III]. J.B. Alberdi, Lat.: S. 27°35.184, Long. W. 65°37.4022′. On *T. stans*, 22 Sep 1997, *J.F. Hennen & J.R. Hernández 97–002* (BPI 841161) [I]. J.B. Alberdi, road to Escaba. On *T. stans*, 28 Nov 1997, *J.R. Hernández 97–099* (BPI 841219) [I]. Road to Villa Nougués. On *T. stans*, 5 May 1995, *J.R. Hernández 95–036* (BPI 841083) [II-III]. San Javier, Parque Sierras de San Javier. On *T. stans*, 27 Mar 1993, *J.F. Hennen, L.D. Ploper & J.R. Hernández 93–027* (LIL 54713, BPI) [I- II]. San Pedro de Colalao. On *T. stans*, 1 Apr 1994, *J.F. Hennen & M.M. Hennen 94–061* (LIL 54715, BPI 841030) [II-III]. San Pedro de Colalao. On *T. stans*, 8 Jul 2000, *J.R. Hernández 00–011* (BPI 841780) [III]. JAMAICA. KINGSTON. On *T. stans*, 19 Feb 1915, *R. Thaxter s.n.* (BPI 46488, BPI 46487—PARATYPES of *Puccinia appendiculata*).

*Commentary.*—Arthur (1907) proposed the genus *Prospodium* based on the type species *Puccinia appendiculata*.

Arthur (1917) listed *Uredo adenocalymmatis* (on *Adenocalymma* cfr. *paulistarum* Bureau & K. Schum. from Brazil, Santa Catarina, *E. Ule 902*) as a taxonomic synonym of *Puccinia cuticulosa*, which was based on an anamorph. However, the rust on *Adenocalymma* is different from the one on *Tecoma* (Hennen et al 1982). Arthur (1917) also cited *Puccinia aequinoctialis* (on *Bignonia aequinoctialis* L. from Cuba, Baracoa, 13 March 1903) as a taxonomic synonym of *Puccinia cuticulosa*. *Puccinia aequinoctialis* later was transferred to *Prospodium* as a distinct species (Cummins 1940).

***Prospodium elegans*** (J. Schröt.) Cummins, Lloydia 3: 67. 1940. FIGS. 11, 12, 25, 26




FIGS. 25–31. *Prospodium elegans* and *Prospodium perornatum*. 25. Median view of teliospores of *P. elegans*, 26. Surface view of 25, 27. Spermogonium of *P. perornatum*, 28. Aecial galls on capsules of *Tabebuia avellanedae*, 29. Aecia on distorted young branches of *T. avellanedae*, 30. Urediniospores of *P. perornatum*, 31. Teliospores of *P. perornatum*. Bars = 10 μm.

≡ *Puccinia elegans* J. Schröt. in Henn., Hedwigia 35: 238. 1896.
≡ *Nephlycitis elegans* (J. Schröt.) Arthur, J. Mycol. 13: 32. 1907.
= *Puccinia hymenochaetoides* Henn., Bot. Jahrb. Syst. 40: 226. 1908.

Spermogonia amphigenous on nondistorted leaves, distorted leaves and branches, or galls on the fruit. Aecia and uredinia not produced. Telia surrounding or among spermogonia, on leaves or on witches' broom-like growths, dark cinnamon-brown, pulverulent; teliospores oblong-ellipsoid or broadly ellipsoid, only slightly constricted at septum, (30–) 35–43 (–46) × (20–) 22–28 (–30) μm, wall 3–4 (–5) μm at sides, 4–6 (–7) μm over pores, little or no lamination, clear chestnut-brown or dark golden-brown, echinulate with cones spaced (2.5–) 3–5 μm apart, pore of upper cell apical, on lower cell near pedicel, each in a slightly paler, thickened area or, less commonly, with a defined umbo; pedicel broken about 12–15 μm below spore at a fracture zone or septum, sometimes with small appendages at the fracture zone.

*Hosts and distribution.—Tecoma garrocha* Hieron., Argentina (Jujuy and Salta); *Tecoma stans* (L.) Juss. ex Kunth in H.B.K., Argentina (Catamarca), Haiti, Peru; *Tecoma* sp., Ecuador; Bignoniaceae undtn., Brazil, Peru.

*Specimens examined.*—ARGENTINA. SALTA: Cafayate. On *Tecoma garrocha,* 9 Apr 1994, *J.F. Hennen, M.M. Hennen & J.R. Hernández 94–115* (LIL 54717, BPI 841048) [III].

*Commentary.*—*Prospodium elegans* is an autoecious, microcyclic rust. Spermogonial and telial states have been described. The infections produce compact, succulent witches' brooms. Old infections change the natural shape of buds, young branches and pods, which may appear as distorted curled structures hanging from branches. When heavily infected, tender buds are covered by telia and have a powdery, dark-brown appearance. Galls have been reported on fruit.

*Prospodium elegans* is reported from South America and the Caribbean Islands. It is similar to *Prospodium transformans* (Ellis & Everh.) Cummins from North and Central America, and the Caribbean Islands. *Prospodium transformans* is the only other microcyclic species of *Prospodium* on *Tecoma* (Cummins 1940), and it differs from *P. elegans* in that the teliospores of the former are shorter and not constricted at the septum.

*Prospodium manabii* R. Berndt (1998), also microcyclic, was described on an undetermined Bignonaceae from Manabi, Ecuador, and appears to be the same as *P. transformans,* based on comparison of type specimens. It is possible that some or all of the reports of *P. elegans* from the Caribbean Islands are *P. transformans.*

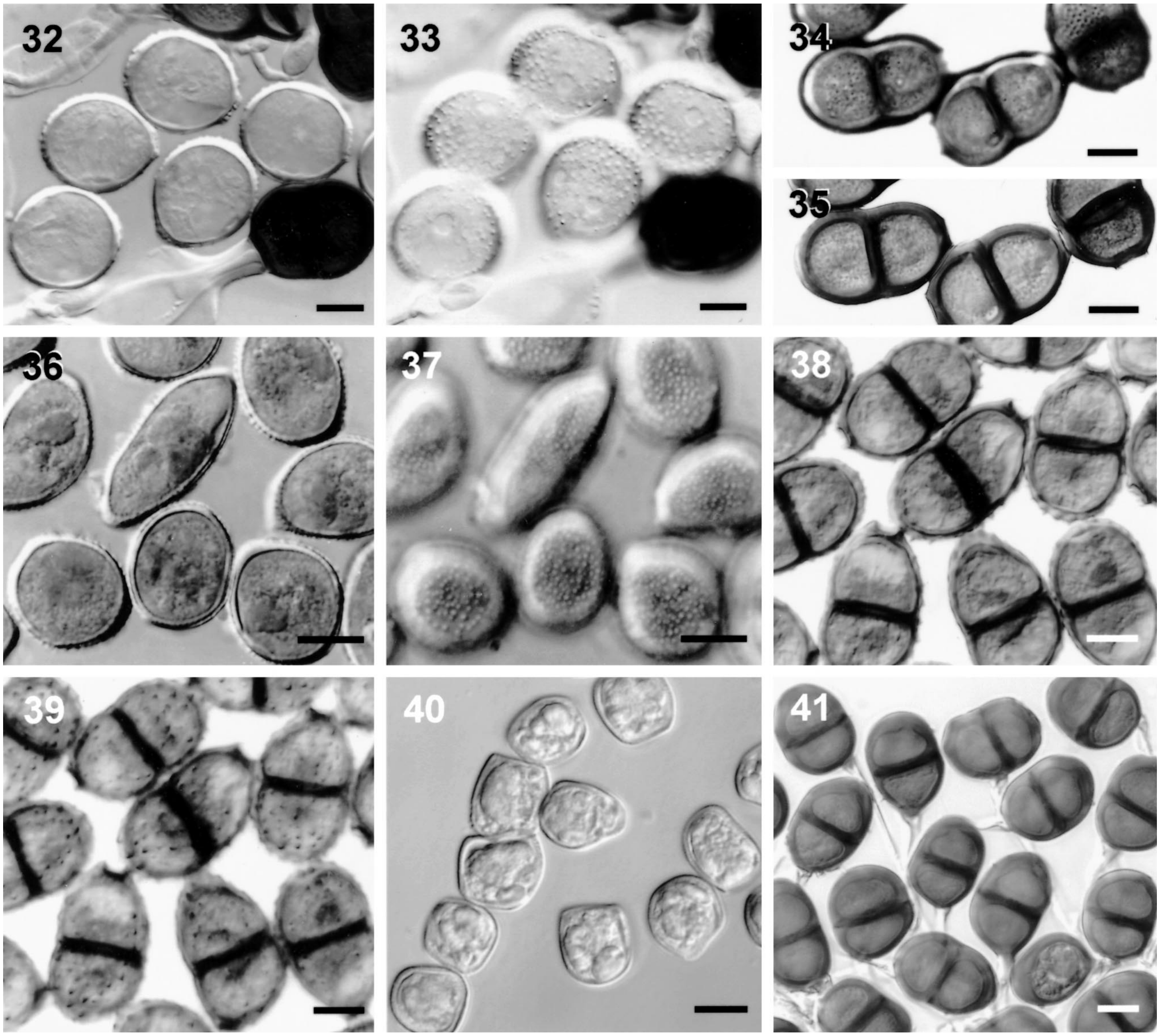
***Prospodium perornatum*** Syd., Ann. Mycol. 34: 411. 1936. FIGS. 19–24, 27–31

Spermogonia epiphyllous, appearing as reddish dots, on rounded, intense green, swollen areas on leaflets, and on young stems and capsules. Aecia subcuticular in origin, hypophyllous at first, later amphigenous, when located on veins leaflet folded, and on young branches, petioles and capsules, erumpent, confluent, in rounded cinnamon-brown gall areas of to 2.5–3 cm diam, later often surrounding the whole organ; aeciospores 25–29 (–35) × (18–) 22–27 μm, laterally compressed, pores 2, equatorial, wall bilaminate, the outer layer 2–5 μm thick, aculeate, with cones 1–2.5 μm long, inner wall 1.5–2 μm thick, golden cinnamon-brown. Uredinia hypophyllous suprastomatal, cinnamon-brown, with cylindrical paraphyses 20–30 μm long, on rim of peridial cup; urediniospores (22–) 24–28 × (21–) 23–27 μm, 16–19 μm wide in side view, pores 2, equatorial, wall bilaminate, outer layer partially covering the spore, 2.5–3.5 (–4) μm thick, surrounding entire margin when spore in face view, in lateral view layer extending from apex to base of spore, unicapitate, absent on lateral walls, aculeate with tapered or nearly cylindrical rods embedded in outer layer, inner wall 1.5 (–2) μm thick, golden or pale cinnamon-brown, pores 2, equatorial in flattened sides. Telia suprastomatal, as uredinia except blackish brown; teliospores (30–) 33–37 (–40) × (24–) 25–28 (–30) μm, broadly ellipsoid, only slightly constricted at septum, wall obviously bilaminate, outer wall golden, 1–1.5 μm thick or slightly thicker at septum and over pores, echinulate with cones 1.5 (–2) μm long, spaced 3–4 (–5) μm, inner wall 2–3.5 μm thick, dark chestnut-brown, pores apical in upper cells, next to pedicel in lower cell, with inconspicuous umbos 3–4 μm thick; pedicel nearly hyaline, to about 80 μm long, adorned on lower part with whorls of branched appendages, uppermost 7–14 μm long, others progressively shorter becoming warts at base.

*Hosts and distribution.*—*Tabebuia avellanedae* Lorentz ex Griseb. [≡ *Tecoma avellanedae* (Lorentz ex Griseb.) Speg.], Argentina; *Tabebuia chrysantha* (Jacq.) G. Nicholson, Mexico; *Tabebuia palmeri* Rose, Mexico; *Tabebuia pentaphylla* (DC.) Hemsl., Mexico; *Tabebuia* sp., Mexico.

*Specimens examined.*—ARGENTINA. JUJUY: Parque Nacional Calilegua. On *Tabebuia avellanedae*, 8 Dec 1997, *J.R. Hernández 97–181* (BPI 841269) [0-I]. SALTA: Dept. Santa Victoria, La Misión. On *T. avellanedae*, 30 Jun 1996, *J.R. Hernández 96–057* (BPI 841934) [III]. TUCUMÁN: Cevil Pozo, 12–15 km E of San Miguel de Tucumán. On *T. avellanedae*, 30 Mar 1993, *J.F. Hennen & J.R. Hernández 93–056* (LIL 54739, BPI) [II-III]. Dept. Capital. On *T. avellanedae*, 1 Nov 1995, *J.R. Hernández 95–062* (BPI 841095) [0-I]. *J.R. Hernández 95–061* (BPI 841933) [0-I]. On *T. avellanedae*, 4 Apr 1994, *J.F. Hennen & J.R. Hernández 94–080* (LIL 54718, BPI 841931) [II-III]. On *T. avellanedae*, 16 Aug 2001, *J.R. Hernández 01–013* (BPI 841773) [III]. Quinta Agronómica. On *T. avellanedae*, 31 Oct 1997, *J.R. Hernández 97–070* (BPI 841936) [0-I]. Dept. Monteros. On *T. avellanedae*, 29 Oct 1996, *J.R. Hernández 96–077* (BPI 841935) [0-I]. El Corte. On *T. avellanedae*, 15 Feb 1995, *J.R. Hernández 95–067* (BPI 841099) [0-I]. El Manantial. On *T. avellanedae*, 27 Sep 1997, *J.F. Hennen & J.R. Hernández 97–064* (BPI 841198) [0]. Horco Molle, Parque Sierras de San Javier. On *T. avellanedae*, 6 Apr 1994. *J.F. Hennen, M.M. Hennen & J.R. Hernández 94–092* (LIL 54719, BPI 841932) [II-III]. San Javier. On *T. avellanedae*, 21 Mar 1995, *J.R. Hernández 95–072* (BPI 841103) [II-III]. Yerba Buena. On *T. avellanedae*, 5 Oct 1997, *J.R. Hernández 97–074* (BPI 841937) [0].

*Commentary.*—*Prospodium perornatum* is an autoecious, macrocyclic rust. Only uredinial and telial



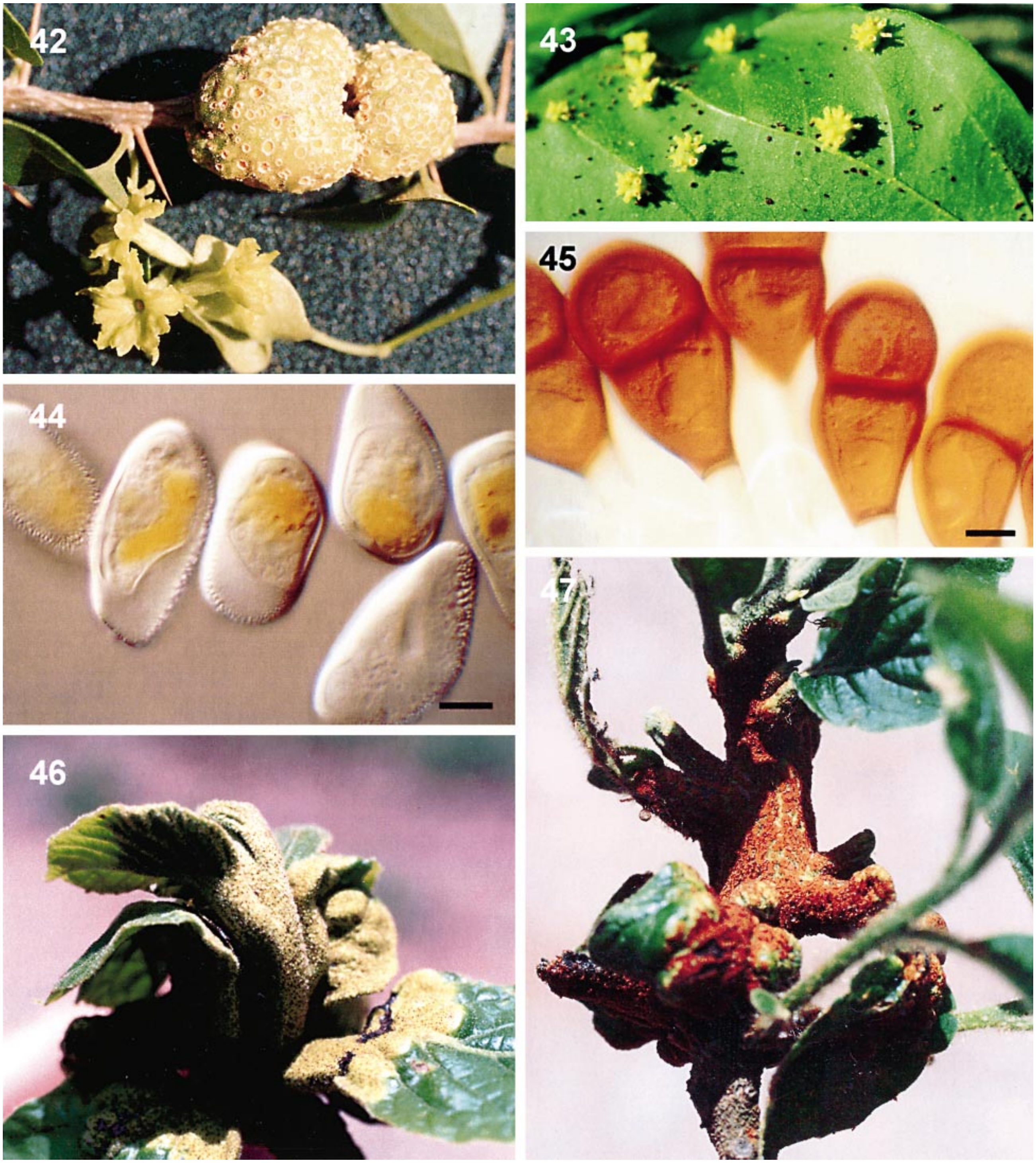

FIGS. 32–41. *Puccinia bougainvilleae*, *Puccinia cordiae* and *Puccinia pampeana*. 32. Median view of urediniospores and teliospore of *P. bougainvilleae*, 33. Surface view of 32, 34. Surface view of punctate teliospores of *P. bougainvilleae*, 35. Median view of 34, 36. Median view of aeciospores of *P. cordiae*, 37. Surface view of 36, 38. Median view of teliospores of *P. cordiae*, 39. Surface view of 38, 40. Spores of *Endophyllum* state of *P. pampeana*, 41. Teliospores of *P. pampeana*. Bars = 10 μm.

states were described previously, but we describe spermogonia and aecia (BPI841933, BPI 841095, BPI 841099, BPI 841935, BPI 841198, BPI 841936, BPI 841937, BPI 841269). Large quantities of aeciospores are produced and, when galls are touched, the spores are released as dense cinnamon-colored powder.

***Puccinia bougainvilleae*** J. Schröt. in Henn., Hedwigia 35: 232. 1896. FIGS. 32–35, 42–45

*Anamorph*. ***Aecidium bougainvilleae*** Speg., Anales Soc. Ci. Argent., Pug. IV, 12: 76. 1881.

Spermogonia amphigenous, subepidermal, globose, with periphyses. Aecia grouped on rounded, hypertrophied areas on leaves, on stems forming golden-yellow galls of varying size, yellowish, cylindrical, 1 mm high, with smooth edges, peridial cells rectangular in face view, external walls smooth, internal walls verrucose-striate; aeciospores obovoid or polyhedral, 32–40 × 25–36 μm, wall hyaline, 2.5–3 μm at sides, 7–8 μm at the apex. Uredinia amphigenous, rounded, naked, pulverulent, cinnamon-brown; urediniospores globose or obovoid, 34–40 × 27–30 μm, wall hyaline, 1.5–2 μm thick, thicker at apex, spines not abundant, 2 equatorial germ pores. Telia amphi-




FIGS. 42–47. *Puccinia bougainvilleae* and *Puccinia cordiae*. 42. Aecial galls of *P. bougainvilleae* on stems of *Bougainvillea stipitata*, 43. Aecial galls and telia of *P. bougainvilleae* on leaf of *B. stipitata*, 44. Aeciospores of *P. bougainvilleae*, 45. Teliospores of *P. bougainvilleae*, 46. Spermogonia of *P. cordiae* on abnormal growth of *Cordia* sp., 47. Aecia of *P. cordiae* on abnormal growth of *Cordia* sp. Bars = 10 μm.

genous, rounded, pulverulent, chestnut-brown almost black, naked; teliospores ellipsoidal, oblong-ellipsoidal, 40–50 × 25–32 μm, rounded or attenuated at apex, constricted at septum, wall punctate, cinnamon-brown, frequently with two germ pores in lower cell, and one germ pore in upper cell; pedicel hyaline, thick, persistent, swollen and appearing as a thick tube in mounting medium, often bursting.

*Hosts and distribution.*—*Bougainvillea frondosa* Griseb., Argentina (Tucumán); *Bougainvillea stipitata* Griseb., Argentina (Catamarca, Córdoba, Jujuy, Salta, Tucumán); *Bouganvillea* sp., Argentina; substrate undtn., Argentina.

*Specimens examined.*—ARGENTINA. CATAMARCA: El Rodeo. On *Bougainvillea stipitata*, 29 Nov 1997, *J.R. Hernández 97–127* (BPI 841232) [I]. JUJUY: San Pedro. On *B. stipitata*, 2 Apr 1993, *J.F. Hennen & L.D. Ploper 93–106* (LIL 54885, BPI) [0-I-II-III]. TUCUMÁN: San Javier, Parque Sierras de San Javier. On *B. stipitata*, 23 Jul 1994, *J.R. Hernández 94–164* (LIL 54887, BPI) [I-II- III]. San Pedro de Colalao. On *B. stipitata*, 16 Jul 1992, *J.R. Hernández & A.Würschmidt 92–008* (BPI) [I]. On *B. stipitata*, 1 Apr 1994, *J.F. Hennen & M.M. Hennen 94–050* (LIL 54886, BPI 841025) [I-II- III].

*Commentary.*—Spermogonial and aecial states are produced on conspicuous galls that have a distinctive golden-yellow color. They begin to develop in the spring when the *Bougainvillea* is budding. On leaves, infections result in numerous pustulate to crateriform swellings on the abaxial surface (FIG. 43), seen on the adaxial surface as circular depressions. Similar symptoms occur on petioles and young branches. On older branches, galls range in size from a few millimeters to 4–5 centimeters or more and the aecia appear as perforations in the galls (FIG. 42).

Schroeter (in Hennings 1896) based his description of *Puccinia bougainvilleae* on two collections, but he did not designate a type. We choose as lectotype the oldest collection (from Argentina. Tucumán: Sierras de Tucumán. On *Bougainvillea frondosa* Griseb. [Nyctaginaceae] Mar 1872, *P.G. Lorentz s.n.*), which also is from the region where our collections were obtained.

*Puccinia bougainvilleae* is known only from Argentina in the provinces of Catamarca, Córdoba (Hennings 1896, Spegazzini 1881, 1912, 1926, Lindquist 1952, 1956, 1982), Jujuy (specimens in BPI, specimens above), Salta (Lindquist 1982, Spegazzini 1881,1925) and Tucumán (Hennings 1896, Lindquist 1952, 1982). Known hosts are two species of *Bougainvillea* (Nyctaginaceae), a genus of about 23 species from tropical and subtropical America. No rust has been reported on *B. glabra* Choisy and *B. spectabilis* Willd., species that are cultivated for their spectacularly pigmented floral bracts.

***Puccinia cordiae*** Arthur, Mycologia 8: 17. 1916.
FIGS. 36–39, 46, 47

≡ *Bullaria cordiae* (Arthur) Arthur & Mains in Arthur, N. Am. Fl. 7: 492. 1921.

*Anamorph.* ***Caeoma*** sp.

= *Uredo cordiae* Henn., Hedwigia 43: 163. 1904.

Spermogonia and aecia on witches' brooms resulting from distortion and hypertrophy caused by systemic infection, sori grouped in areas of 1–2 cm diam or scattered on distorted tissue. Spermogonia conspicuous, chestnut-brown, globoid, 80–144 μm diam with ostiolar periphyses forming a column up to 144 μm long. Aecia close to spermogonia, 0.2–0.4 mm diam, subepidermal in origin, erumpent, ruptured epidermis evident, chestnut-brown, pulverulent, with a few or usually no paraphyses; aeciospores 28–32 × 15–23 μm, catenulate in origin, broadly ellipsoid to globoid, wall light cinnamon-brown, 1.5–2 μm thick, 4–7 μm thick at apex, verrucose, pores 3–4, obscure, probably equatorial. Uredinia mostly hypophyllous, sometimes on flowering parts, 0.1–1.0 mm diam, scattered; paraphyses a single, peripheral band, silvery-shiny in mass at low magnification, erect, arising from a short membranous base that is 2–3 cells deep, terete, hyaline, 37–77 × 10–18 μm, wall hyaline, smooth, inner wall thin, about 1 μm thick, the outer wall thicker, 3–7 μm thick; urediniospores catenulate in origin, similar to aeciospores in shape, 29–35 × 21–26 μm, wall 1.5–2 μm thick at sides, 5–12 μm thick at apex, finely verrucose. Telia amphigenous, sometimes on flowering parts, scattered, rounded, 0.1–1.0 mm across, erumpent, chestnut-brown, paraphyses as in uredinia; teliospores ellipsoid, 37–55 × 19–26 μm, rounded at both ends, wall chestnut-brown, 2.5–3 μm thick, coarsely verrucose, mainly at the apex, pores with distinct plugs; pedicel hyaline, 30–40 × 6–9 μm, swelling to about 20 μm in liquid media.

*Hosts and distribution.*—*Cordia alliodora* (Ruiz & Pav.) Oken, Brazil, Dominican Republic, Guatemala, Mexico, Puerto Rico, Trinidad and Tobago, Virgin Islands; *Cordia gerascanthus* L., Argentina, Costa Rica, Cuba, Guatemala, Uruguay; *Cordia sonorae* Rose, Mexico; *Cordia trichotoma* (Vell.) Arráb. ex Steud., Brazil; *Cordia* sp., Argentina, Brazil, Guatemala, Peru, U.S.A.; substrate undtn., Guatemala.

*Specimens examined.*—ARGENTINA. JUJUY: Parque Nacional Calilegua. On *Cordia* sp., 8 Dec 1997, *J.R. Hernández 97–178* (BPI 841266) [I]. SALTA: Dept. Güemes. On *Cordia* sp., 7 Dec 1997, *J.R. Hernández*

*97–171* (BPI 841938) [III]. JUJUY: Quinta close to Laguna de la Brea. On *Cordia gerascanthus*, 13 Jun 1901, *Rob. E. Fries s.n.* (Vestergren's exsiccata ''Micromicetes Rariores Selecti'', fascicle LV No. 1374, BPI 58817) [II-III]. PUERTO RICO. Ponce. On *C. alliodora*, Jan 1911, *E.W.D. Holway 25* (BPI 58813, LECTOTYPE of *Puccinia cordiae*, herein designated) [II-III].

*Commentary.—Puccinia cordiae* first was named *Uredo cordiae* by P. Hennings (1904). The type specimen was collected by E. Ule from Tarapoto, Peru, on *Cordia* sp. and was composed of witches' brooms with spermogonia and aecia. The teleomorph of this rust was not described until Arthur (1916) found telia on a specimen from Puerto Rico and published the name *Puccinia cordiae*. Later, when Arthur (1918) found spermogonia, aecia, uredinia and telia of *Puccinia cordiae* on a specimen from Guatemala collected by E.W.D. Holway, he concluded that the spermogonia and aecia matched those of *Uredo cordiae* and included that name in his synonomy. When Arthur (1921 in Arthur 1907–1927) transferred *Puccinia cordiae* to *Bullaria*, he cited *Uredo cordiae* as the basionym because he interpreted it as the oldest name. However, the basionym is *P. cordiae* because the ICBN requires that only teleomorph names be used as basionyms for holomorphs.

Neither the aecial or uredinial anamorph of *Puccinia cordiae* should be placed in *Uredo* because the spores of both are catenulate in origin, traits reported here for the first time. The genus *Uredo* is characterized by pedicellate spores. The correct genus for both of these anamorphs of *P. cordiae* is *Caeoma*. The uredinial anamorph differs from the aecial anamorph in the characteristic peripheral paraphyses in the sori, these being absent in the latter.

In 1909 the name *Puccinia cordiae* Vestergr. (NY 53613, BPI 58817) was used on specimens distributed in Vestergren's exsiccata ''Micromicetes Rariores Selecti'', fascicle LV No. 1374. The collection came from Laguna de la Brea, Jujuy, Argentina. No description or diagnosis of the teleomorph was published so this name is a *nomen nudum*. However, this material is significant because it is the only previous record of this rust from Argentina and was collected in the same region as our collections. This species was not included in Lindquist's book (1982). It was reported for the first time from Argentina in Hernández and Hennen (2002a).

Hennen et al (1982) erroneously placed *Uromyces cordiae* Henn. as a synonymn of *Puccinia cordiae* Arthur because they were not aware that the host of *Uromyces cordiae* was, in fact, a *Tournefortia* sp. *Uromyces cordiae* is now known to be a name for the uredinial anamorph of *Uromyces dolichosporus* Dietel & Holw. on *Tournefortia* sp. This rust has been reported in the Americas from Brazil to Mexico but not from Argentina.

The only other rust recorded in Argentina on *Cordia* is *Aecidium cordiae* Henn. (Linquist 1982), which produces peridiate aecia, whereas the anamorph of *P. cordiae* has no peridium.

Three other closely related species of *Puccinia* occur on *Cordia* spp. in the Neotropics. The teliospores of these species are similar, even in their unique pore plugs. In the long-cycle species both the urediniospores and aeciospores are catenulate. The best traits to use in identifying *P. cordiae* are the verrucose anamorph spore walls together with the larger size of the anamorph and teleomorph spores. This key shows the differences between species of *Puccinia* on *Cordia*.

### KEY TO SPECIES OF *PUCCINIA* ON *CORDIA* IN THE NEOTROPICS

1. Only telia produced; in lesions on leaves, twigs and trunks (Known only from Trinidad and Tobago). . . . . . . . . . . . . . . . . . . . . . ***P. corticola*** Arthur & J.R. Johnst. (Arthur 1922)
1. Telia and other states produced . . . . . . . . . . . . . . . . . . . . 2
2. Urediniospores echinulate (Known from Mexico, Central America, and Caribbean Islands). . . . . . . . . . . . . . . . . . . . . . . . . . . ***P. johnstonii*** Arthur (Arthur and Johnston 1918)
2. Urediniospores verrucose . . . . . . . . . . . . . . . . . . . . . . . . 3
3. Urediniospores 20–27 × 16–20 μm, teliospores 28–38 × 18–26 μm, without abnormal growth (Known only from Belize) . . . . . . . . . . . . . . . . ***P. ciliata*** Mains (Mains 1939b)
3. Urediniospores 28–35 × 21–25 μm, teliospores 34–55 × 19–26 μm, produces abnormal growths (Widespread from Mexico to Argentina) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ***P. cordiae*** Arthur (Arthur 1916)

***Puccinia pampeana*** Speg., Anales Soc. Ci. Argent. 10: 9. 1880. FIGS. 40, 41, 58–60

≡ *Dicaeoma pampeana* (Speg.) Kuntze. Rev. Gen. Pl. 3: 467. 1898.
= *Puccinia araucana* Dietel & Neger, Bot. Jahrb. Syst. 24: 159. 1897.
= *Puccinia solanina* Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 23: 26. 1912.
= *Puccinia capsici* Mayor, Mém. Soc. Neuchatel Sci. Nat. 5: 501. 1913.
[= *Puccinia capsici* Av.-Saccá, Molestias Cryptogamicas das Plantas Horticolas, São Paulo, p. 61, 1917 (later homonym)]
= *Puccinia paulensis* Rangel, Arch. Jardín Bot. Río de Janeiro 2: 70. 1918.
= *Puccinia gonzalezii* Mayor (as ''*gonzalezi*''), Mém. Soc. Neuchatel Sci. Nat. 5: 502. 1913.

*Endophyllum* state:

***Endophyllum pampeanum*** (Speg.) J.C. Lindq., Bol. Soc. Argentina Bot. 10: 114. 1963.

≡ *Aecidium pampeanum* Speg., Anales Soc. Ci. Argent. 10: 11. 1880.
= *Aecidium solaninum* Speg., Anales Soc. Ci. Argent. 12: 79. 1881.
= *Aecidium solaninum* Speg. var. *laevis*, Anales Mus. Nac. Hist. Nat. Buenos Aires 19(3): 470. 1909.
= *Aecidium capsici* F. Kern & Whetzel, J. Dept. Agr. Puerto Rico 14. 341. 1930.
[≡ *Puccinia capsicicola* F. Kern & Thurst. Mycologia 32: 625. 1940. *nomen nudum.*]

Spermogonia not seen. Aecidioid sori (*Endophyllum* state, functioning as telia) amphigenous, caulicolous, on witches' brooms, cupulate, 0.2–0.4 mm across, subepidermal in origin, erumpent; peridial cells polyhedral, outer wall finely verrucose, inner wall strongly verrucose to irregularly striate verrucose, 17–24 (–27) × (13–) 14–15 (–17) μm; aecioid spores globoid, ellipsoid or polyhedral, 20 (–24) × (11–) 12–14 (–15) μm, wall 1.5–2 μm thick, hyaline, finely verrucose. Telia small, within aecidioid sori, or on petioles or young branches, chestnut-brown, naked, pulverulent; teliospores ellipsoid, rounded at both ends, not constricted at septum, 31–33 × 21–24 μm, smooth, wall chestnut-brown, variable in thickness, in some spores uniformly 4–5 μm, in others 5–6 μm, pore of upper cell apical, of lower cell close to the septum or halfway between septum and pedicel; pedicel hyaline, fragile.

*Hosts and distribution.*—*Acnistus arborescens* (L.) Schltdl., Argentina, Peru; *Acnistus breviflorus* Sendtn., Brazil; *Acnistus parviflorus* Griseb., Argentina, Brazil; *Acnistus* sp., Brazil, Ecuador; *Capsicum annuum* L., Brazil, Guatemala, Peru; *Capsicum baccatum* L., Bolivia, Brazil, Colombia; *Capsicum ciliatum* (Kunth) Kuntze, Maxico; *Capsicum frutescens* L., Brazil, Mexico; *Capsicum microcarpum* DC., Brazil; *Capsicum pendulum* Willd., Brazil; *Capsicum* sp., Brazil, Colombia; *Cestrum* sp., Argentina, Brazil; *Dunalia breviflora* (Sendtn.) Sleumer, Argentina; *Dunalia lycioides* Miers, Bolivia; *Salpichroa diffusa* Miers, Argentina; *Salpichroa origanifolia* (Lam.) Baill., Argentina, Uruguay; *Salpichroa rhomboidea* (Hook.) Miers, Argentina, Brazil, Uruguay; *Salpichroa* sp., Brazil; *Solanum cyrtopodium* Dunal, Chile; *Solanum lycioides* L., Bolivia; *Solanum valdiviense* Dunal, Brazil, Chile; *Solanum* sp., Argentina, Chile; substrate undtn., Argentina.

*Specimens examined.*—ARGENTINA. CATAMARCA: Dept. Ambatos, El Rodeo. On *Salpichroa origanifolia*, 23 Sep 1997, *J.F. Hennen & J.R. Hernández 97–047* (BPI) [III]; 97–048 (BPI) [III]. Los Altos. On *S. origanifolia*, 15 Dec 1975, *A. Villegas s.n.* (LIL) [III]. CÓRDOBA: Sierra Chica, near San José. On *Acnistus parviflorus* (host misidentified as *A. arborescens*), 11 Jan 1877, *Hieronymus s.n.*(BPI 153310, TYPE of *Aecidium solaninum*) [aecioid III]. SALTA: ''camino de corniza'' between Salta and Jujuy. On *Cestrum* sp., 7 Dec 1997, *J.R. Hernández 97–176A* (BPI 841264) [aecioid III]. El Potrero. On *S. origanifolia*, 21 Aug 2001, *J.R. Hernández 01–016* (BPI 841774) [aecioid III-III]. *J.R. Hernández 01–017* (BPI 841775) [aecioid III-III]. *J.R. Hernández 01–018* (BPI 841776) [aecioid III-III]. TUCUMÁN: Dept. Trancas, Chaschi. On *Cestrum parqui*, 8 Nov 1959, *R.T. Singer s.n.* (BPI 103503) [aecioid III]. 0?-I-III was written on the label of the specimen identified by Lindquist, however we observed only aecioid spores. San Pedro de Colalao. On *Cestrum* sp., 1 Apr 1994, *J.F. Hennen & M.M. Hennen 94–052* (LIL 54920, BPI 841940) [aecioid III]. Tafí Viejo. On *Cestrum* sp., 24 Nov. 2000, *A.Würschmidt & J.R. Hernández 00–027* (BPI 841779) [aecioid III]. Dept. Trancas, Rt. 9, km 1364. On *S. origanifolia*, 26 Oct 1995, *J.R. Hernández 95–054* (BPI 841942) [III]. El Manantial. On *S. origanifolia*, 31 Mar 1994, *J.R. Hernández 94–166* (BPI 841941) [III-III]. Horco Molle. On *S. origanifolia*, 13 Sep 1997, *J.R. Hernández 97–066* (BPI 841200) [III-III]. *J.R. Hernández 97–077* (BPI 841206) [III-III]. NW of San Miguel de Tucumán. On *S. origanifolia*, 31 Mar 1993, *J.F. Hennen & J.R. Hernández 93–044* (LIL 54926, BPI) [III-III]. BRAZIL. PORTO ALEGRE: On *Acnistus breviflorus*, 31 Oct 1960, *A.T. Quintas s.n.* (BPI 103502) [III-III]. CHILE. Cordillera de Villarica. On *Solanum cyrtopodium*, Feb 1897, *F.W. Neger* (Bound exsiccati BPI, Vestergren XII, 1160, LECTOTYPE; BPI 046536, ISOLECTOTYPE of *Puccinia araucana*) [III-III]. Recinto. On *S. cyrtopodium*, 10 Jan 1920, *E.W.D. Holway & M.M Holway* (BPI 046535) [III]. ECUADOR. Huigra, Chimborazo. On *Acnistus* sp., 8 Aug 1920, *E.W.D. Holway & M.M Holway* (BPI 103501) [III-III]. (BPI 103500) [III-III].

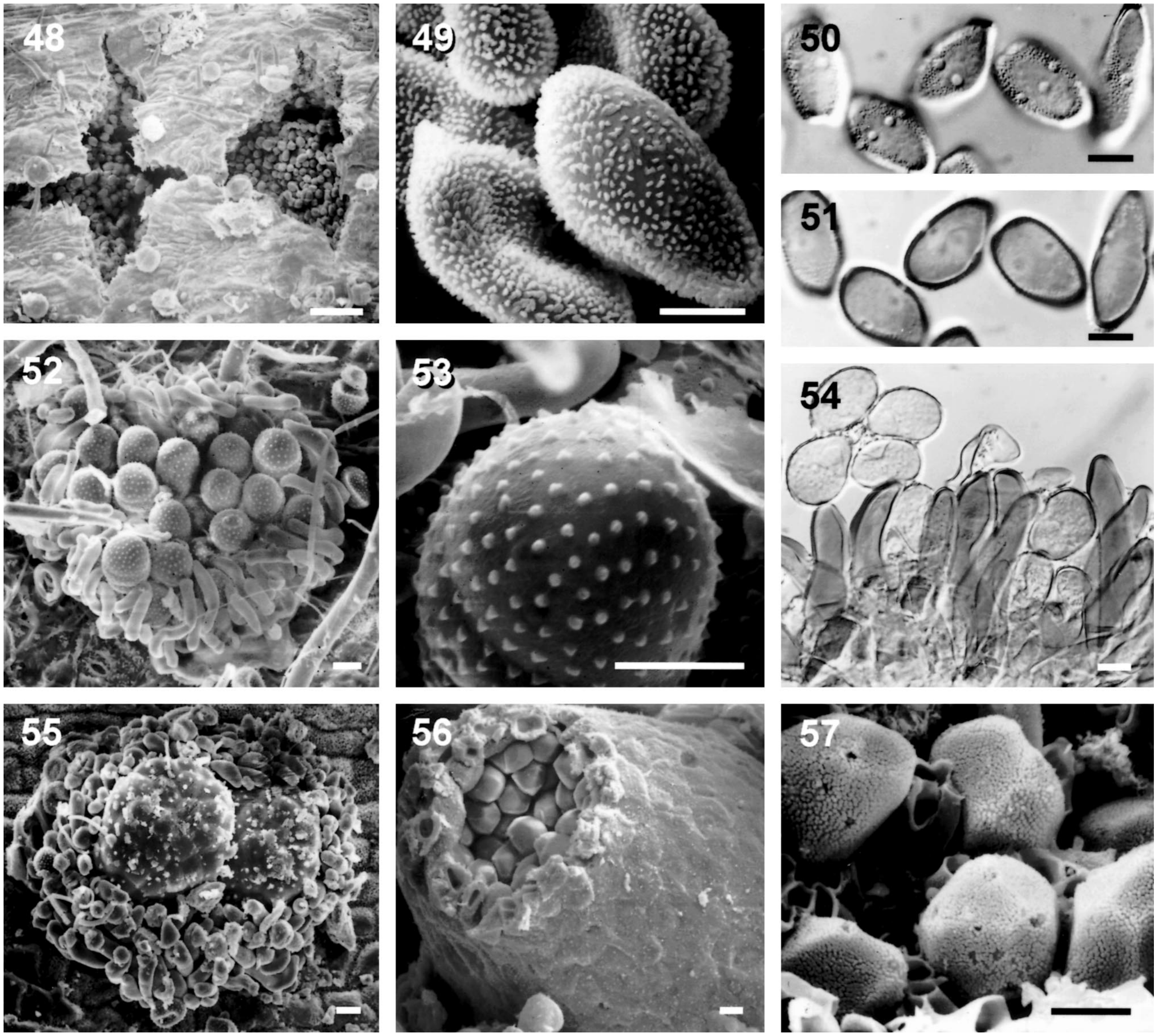
*Commentary.*—Both spore states of *Puccinia pampeana* function as teliospores (Hennen et al 1984). *Puccinia pampeana* occurs on many members of the Solanaceae and causes an economically important disease of *Capsicum* in Central and South America.

*Puccinia araucana* is identical morphologically to *Puccinia pampeana* and is considered to be a synonym (Hennen et al 1984, Pardo-Cardona 1994, Buritica and Pardo-Cardona 1996).

Lindquist (1982) considered *Puccinia araucana* to be a synonym of *P. solanina* and used the name *P. solanina* for this species. However, *P. araucana* is an earlier name and has priority.

***Ravenelia argentinica*** J.R. Hern. & J.F. Hennen. Mycol. Res. 106: 995. 2002. FIGS. 48–55, 61, 62

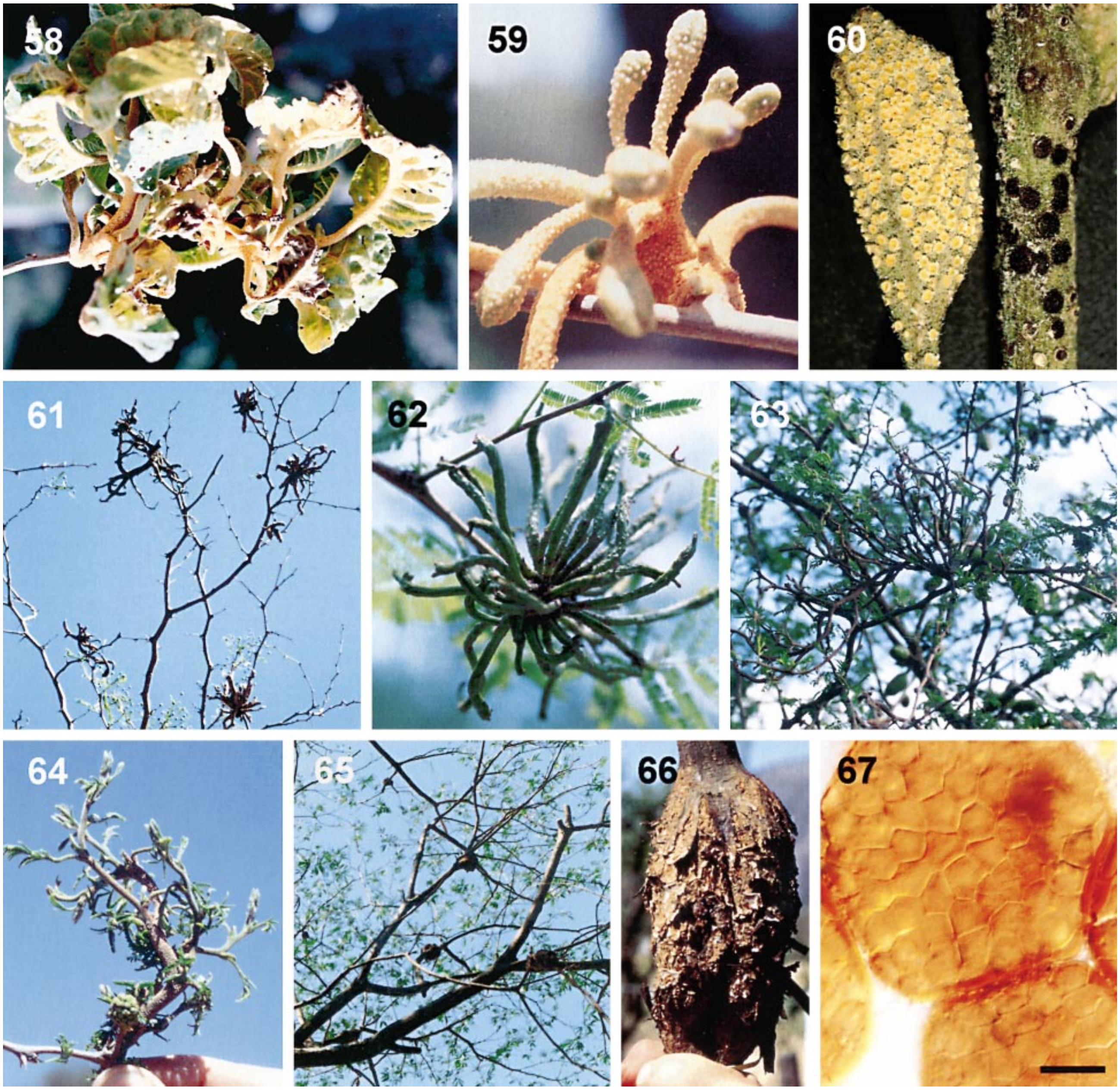
Anamorph: ***Caeoma*** sp.




FIGS. 48–57. *Ravenelia argentinica* and *Ravenelia hieronymi*. 48. SEM of Aecia of *R. argentinica*, 49. SEM of aeciospores of *R. argentinica*, 50. Surface view of aeciospores of *R. argentinica*, 51. Median view of 50, 52. SEM of uredinium of *R. argentinica*, 53. SEM of urediniospore of *R. argentinica*, 54. Urediniospores and paraphyses of *R. argentinica*, 55. SEM of teliospores produced in uredinium of *R. argentinica*, 56. SEM of Aecium of *R. hieronymi*, 57. SEM of aeciospores of *R. hieronymi*. FIG. 48 Barr = 80 μm. FIGS. 49–57 Bars = 10 μm.

= *Ravenelia argentinensis* Speg., Revista Argent. Bot. 1(2a.–3a.): 129. 1925 (name based on anamorph).

Spermogonia not seen. Aecia on abnormal growths on young branches and pods, subepidermal, becoming erumpent, without peridia or paraphyses, yellowish; aeciospores catenulate, obovoid, ellipsoid to oblong-fusiform, sometimes apiculate, 22–26 × 12–18 μm, wall 1.5–2 μm thick at sides, 2.5–3 μm thick at top, yellowish, densely verrucose, pores mostly 4–5, equatorial. Uredinia 0.5–1 μm diam, epiphyllous, rounded, subepidermal, becoming erumpent; paraphyses 50–70 × 7–10 μm, peripheral, slightly incurved, wall cinnamon-brown, slightly thickened dorsally; urediniospores 25–29 × 14–18 μm, pedicellate, obovoid, globose, or broadly ellipsoidal, wall 1.5–2 μm thick, or slightly thicker at an apical papilla, finely echinulate, pores 4, equatorial. Teliospores produced in the uredinia, 80–120 μm diam, dark brown, 6–10 probasidial cells across, cells 15–18 μm diam, 1-layered, each cell with 5–7 (–8) spines, 3–6 μm long; cysts uniseriate, more or less globoid, pendent, hyaline; pedicel multihyphal, deciduous.




FIGS. 58–67. *Puccinia pampeana*, *Ravenelia argentinica*, *Ravenelia hieronymi* and *Ravenelia papillosa*. 58. Witches' broom caused by *Puccinia pampeana* on *Cestrum* sp., 59. Sori of *Endophyllum* state of *P. pampeana* on bud malformation on *Cestrum* sp., 60. *Endophyllum* sori on leaf (left) and telia on stem (right) of *P. pampeana* on *Salpichroa origanifolia*, 61. Witches' brooms caused by *R. argentinica* on *Acacia aroma*, 62. Spidery abnormal growth of *R. argentinica* on *A. aroma*, 63. Witches' brooms of *R. hieronymi* on *A. caven*, 64. Detail of young branch of *A. caven* infected by *R. hieronymi*, 65. Galls caused by *R. papillosa* on branches of *Parapiptadenia excelsa*, 66. Gall of *R. papillosa*, 67. Teliospores of *R. papillosa*. Bar = 20 μm.

*Host and distribution.*—known only on *Acacia aroma* Gillies ex Hook. & Arn. from Argentina.

*Specimens examined.*—ARGENTINA. CORRIENTES: On *Acacia aroma*, 12 Jul 1944, *M. di Fonzo 375* (BPI 149244) [0-I-II-III]. JUJUY: Perico. On *A. aroma* [originally reported as *Vachellia lutea* (Mill.) Speg.], Jan 1906, leg.? (LPS 4941—TYPE of *R. argentinensis*) [I].

*Commentary.*—For additional specimens examined, nomenclatural notes, and comments on the taxonomy of this species, see Hernández and Hennen (2002b).

***Ravenelia hieronymi*** Speg., Anales Soc. Ci. Argent., Pug. IV, 12: 66. 1881. FIGS. 56, 57, 63, 64, 68–70

≡ *Pleoravenelia hieronymi* (Speg.) Long, Bot. Gaz. (Crawfordsville) 35: 127. 1903.

≡ *Cystingophora hieronymi* (Speg.) Arthur, N. Am. Fl. 7: 131. 1907.
= *Ravenelia mimosae* Henn., Hedwigia 34: 95. 1895.
≡ *Ravenelia acaciae-farnesianae* Henn., Hedwigia 34: 321. 1895.
= *Pleoravenelia deformans* Maubl., Soc. Mycol. France 22: 73. 1906.
≡ *Ravenelia deformans* (Maubl.) Dietel, Beih. Bot. Centralbl. 20: 404. 1906.
≡ *Cystingophora deformans* (Maubl.) H. Syd., Ann. Mycol. 19: 165. 1921.

*Anamorph.* ***Aecidium hieronymi*** Speg., Anales Soc. Ci. Argent., Pug. IV, 12: 78. 1881.

Spermogonia erumpent, inconspicuous. Aecia densely scattered over witches' broom on young branches, conspicuous, with long cylindrical peridia, peridial cell walls striate-verrucose; aeciospores (18–) 20–26 (–28) × (13–) 15–20 μm, catenulate, variable in size and shape, often angular, mostly broadly ellipsoid or oblong-ellipsoid, pale yellow or pale golden in mass, wall 2–3 μm thick, densely and finely verruculose, pores 7–10, scattered, relatively obscure. Telia scattered among or produced in aecia, subepidermal becoming erumpent, blackish-brown; teliospores (65–) 75–120 (–140) μm diam, clear chestnut-brown or dark golden-brown, smooth, variable in shape, flat or often concave on the underside, strongly convex on the upperside, thus appearing to be thickened centrally, 5–9 (–12) probasidial cells across but the number difficult to determine at times, two layers of probasidial cells (as observed in longitudinal section), probasidial cells (18–) 21–25 (–27) × (14–) 16–22 μm diam, one germ slit per probasidial cell, pairs of germ slits observed on adaxial spore surface, one belonging to upper probasidial cell, other to lower probasidial cell which extends to spore surface through upper layer of probasidial cells; cysts apparently uniseriate, of same number as peripheral probasidial cells, appressed to underside of the spore, coherent, but often swelling to appear pendent; pedicel multihyphal, hyaline, usually deciduous.

*Hosts and distribution.*—*Acacia caven* (Molina) Molina (= *Acacia cavenia* Bertero ex Bull.), Argentina, Brazil, Chile, Paraguay, Uruguay; *Acacia farnesiana* (L.) Willd., Brazil, Chile, Uruguay.

*Specimens examined.*—ARGENTINA. CÓRDOBA: Sierra Chica, San José, near La Calera. On *Acacia caven*, 11 Jan 1877, *Hieronymus s.n.* (LPS 4930—TYPE of *R. hieronymi*) [I-III].

*Commentary.*—For additional specimens examined, nomenclatural notes, and comments on the taxonomy of this species, see Hernández and Hennen (2002b).

***Ravenelia papillosa*** Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 6: 229. 1898.
FIGS. 65–67, 71, 72

*Anamorph.* ***Uredo leguminicola*** Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 19 (ser.IV): 317. 1909.

Spermogonia and aecia not seen. Uredinia amphigenous and on rachis' and branches on conspicuous galls and witches' brooms, subepidermal, rounded, becoming erumpent, brown, 0.5–1 mm diam, often confluent on abnormal growths; paraphyses yellowish to brown, intermixed, numerous, clavate or clavate-capitate, 40–50 × 14–16 μm, pedicel 5 μm across, thick-walled; urediniospores (18–) 20–24 × (12–) 14–19 μm, broadly ellipsoid or broadly obovoid, wall pale brownish or golden, 2.5–3 μm thick, echinulate, pores 10–12, scattered. Telia following uredinia or formed *de novo,* blackish; paraphyses as in the uredinia; teliospores 88–120 (–130) μm diam, dark chestnut-brown, 7–10 probasidial cells across, wall 7–8 μm thick at the top, with 3–5 cones or conical papillae 2–3 μm high on each probasidial cell, especially obvious peripherally, cells 1-layered; cysts coherent, hyaline, uniseriate, of same number as peripheral probasidial cells, swollen in water; pedicel multihyphal, hyaline, deciduous.

*Hosts and distribution.*—*Acacia visco* Lorentz ex Griseb., Argentina (Buenos Aires); *Parapiptadenia excelsa* (Griseb.) Burkart, Argentina (Catamarca).

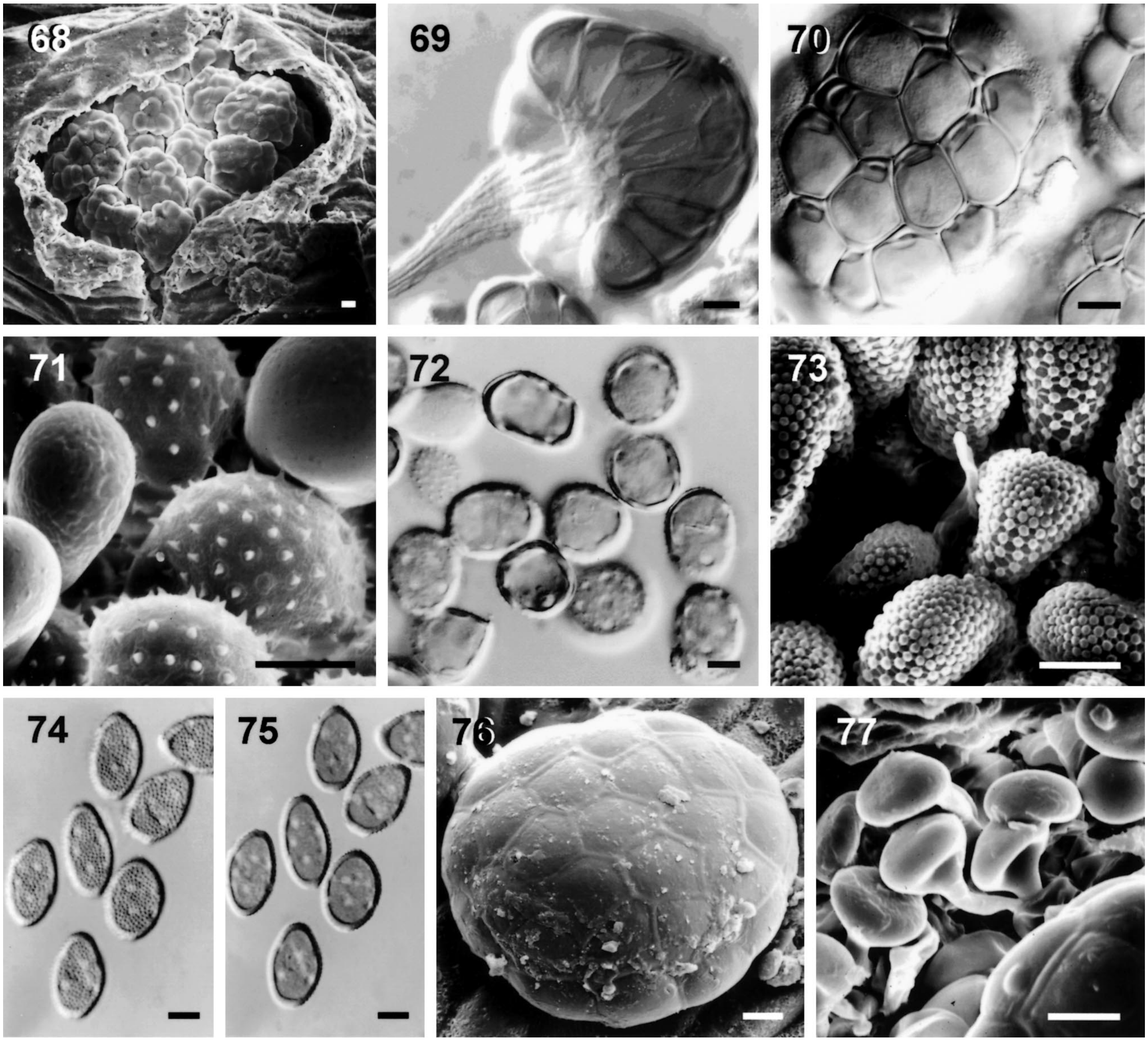
*Specimens examined.*—ARGENTINA. BUENOS AIRES: La Plata, horto botanico. On *Acacia visco* (originally erroneously identified as *Albizia julibrissin* Durazz.), 8 Jun 1897, *Spegazzini s.n.* (LPS 4956—HOLOTYPE, PUR 89579—ISOTYPE, of *R. papillosa*) [III]. BUENOS AIRES: horto botanico bonaerensi. On *A. visco* [originally erroneously identified as *A. lophantha* Willd. and re-identified by Spegazzini as *A. platensis* Manganaro fide Lindquist (1954) which is a synonym of *A. visco*], 6 Mar 1906, *E. Autran s.n.* (LPS 4001—HOLOTYPE of *U. leguminicola*) [II].

*Commentary.*—For additional specimens examined, nomenclatural notes, and comments on the taxonomy of this species, see Hernández and Hennen (2002b).

***Ravenelia spegazziniana*** J.C. Lindq., Bol. Soc. Argent. Bot. 1(4): 298. 1946. FIGS. 73–77

*Anamorph.* ***Uredo*** sp.
= *Ravenelia siliquae* Long, Bot. Gaz. (Crawfordsville) 35: 118. 1903 (name based on uredinia).
≡ *Haploravenelia siliquae* (Long) H. Syd., Ann. Mycol. 19: 165. 1921.

Spermogonia unknown. Aecia on pods and de-



FIGS. 68–77. *Ravenelia hieronymi*, *Ravenalia papillosa* and *Ravenelia spegazziniana*. 68. SEM of telium of *R. hieronymi*, 69. Side view of teliospore of *R. hieronymi*, 70. Surface view of teliospores of *R. hieronymi* showing pairs of germ slits, 71. SEM of echinulate teliospores and smooth paraphyses of *R. papillosa*, 72. Urediniospores of *R. papillosa* with numerous, scattered germ pores, 73. SEM of urediniospores of *R. spegazziniana* showing hub and spoke pattern of ornamentation, 74. Surface view of urediniospores of *R. spegazziniana*, 75. Median view of 74, 76. SEM of teliospore of *R. spegazziniana*, 77. SEM of paraphyses and part of teliospore of *R. spegazziniana*. Bars = 10 μm.

formed young branchlets, deep-seated, without peridium or with a few peridial cells, opening by a rift in epidermis; aeciospores catenulate, 30–36 × 12–18 μm, oblong fusoidal, pentagonal or irregularly polygonal, base usually flat, apex acute, densely echinulate with fine spines, pores 3 or 4, equatorial (from Lindquist 1954). Uredinia on pods and leaflets, subcuticular in origin, in large, confluent groups on pods, small and discrete on leaflets, rachis' and petioles, cinnamon-brown; paraphyses few or numerous, uniformly thin-walled, intrasoral, mostly clavate, nearly hyaline; urediniospores (20–) 23–28 (–30) × (12–) 14–16 (18) μm, mostly ellipsoidal or narrowly obovoid, wall 1.5–2 μm thick at sides, 2–3 μm at apex, pale, rather dull cinnamon-brown, closely verrucose with fine basal connections, hub and spoke pattern of ornamentation, pores in two bands of four each, one above and one below equator. Teliospores in uredinia, spores (65–) 70–95 (–100) μm diam, chestnut-brown with a thin but discrete pale outer layer, appearing smooth, (4) 5–7 probasidial cells across, cells in one layer, central cells (13–) 17–22 (–24) μm across; cysts uniseriate mostly of same number as peripheral cells, globoid, pendent; pedicel hyaline, multihyphal, deciduous.

*Hosts and distribution.*—*Acacia aroma* Gillies ex Hook. & Arn., Argentina; *Acacia catechu* (L.f.) Brandis, U.S.A.; *Acacia farnesiana* (L.) Willd. [= *Vachellia farnesiana* (L.) Wight & Arn.], Cuba, Guatemala, Honduras, Mexico, Nicaragua, Puerto Rico, Virgin Islands, U.S.A.; *Acacia pennatula* (Cham. & Schltdl.) Benth., Mexico, unknown; *Acacia smallii* Isely, Mexico; *Acacia* sp., Mexico.

*Specimens examined.*—ARGENTINA. BUENOS AIRES: La Plata, Jardín Botánico de la Facultad de Agronomía (Eva Perón). On *Acacia aroma*, 16 Jun 1945, *J.C. Lindquist s.n.* (LPS 12604—HOLOTYPE of *R. spegazziniana*) [II-III]. MEXICO. OAXACA: Etla. On *A. farnesiana*, 25 Oct 1899, *E.W.D. Holway 3841* (BPI 191725—HOLOTYPE of *R. siliquae*) [II].

*Commentary.*—For additional specimens examined, nomenclatural notes, and comments on the taxonomy of this species, see Hernández and Hennen (2002b).

***Uromyces cestri*** Mont. in Gay, Bot. Flora Chilena 8: 48. 1852. FIGS. 78–81, 87, 88

≡ *Caeomurus cestri* (Mont.) Kuntze, Revis. Gen. Pl. 3(2): 449. 1898.

≡ *Uromycopsis cestri* (Mont.) Arthur, Résult. Sci. Congr. int. Bot. Wien. p. 345. 1906.

*Anamorph.* ***Uredo cestri*** Bertero in Mont., Ann. Sci. Nat. Bot. II 3: 356. 1835

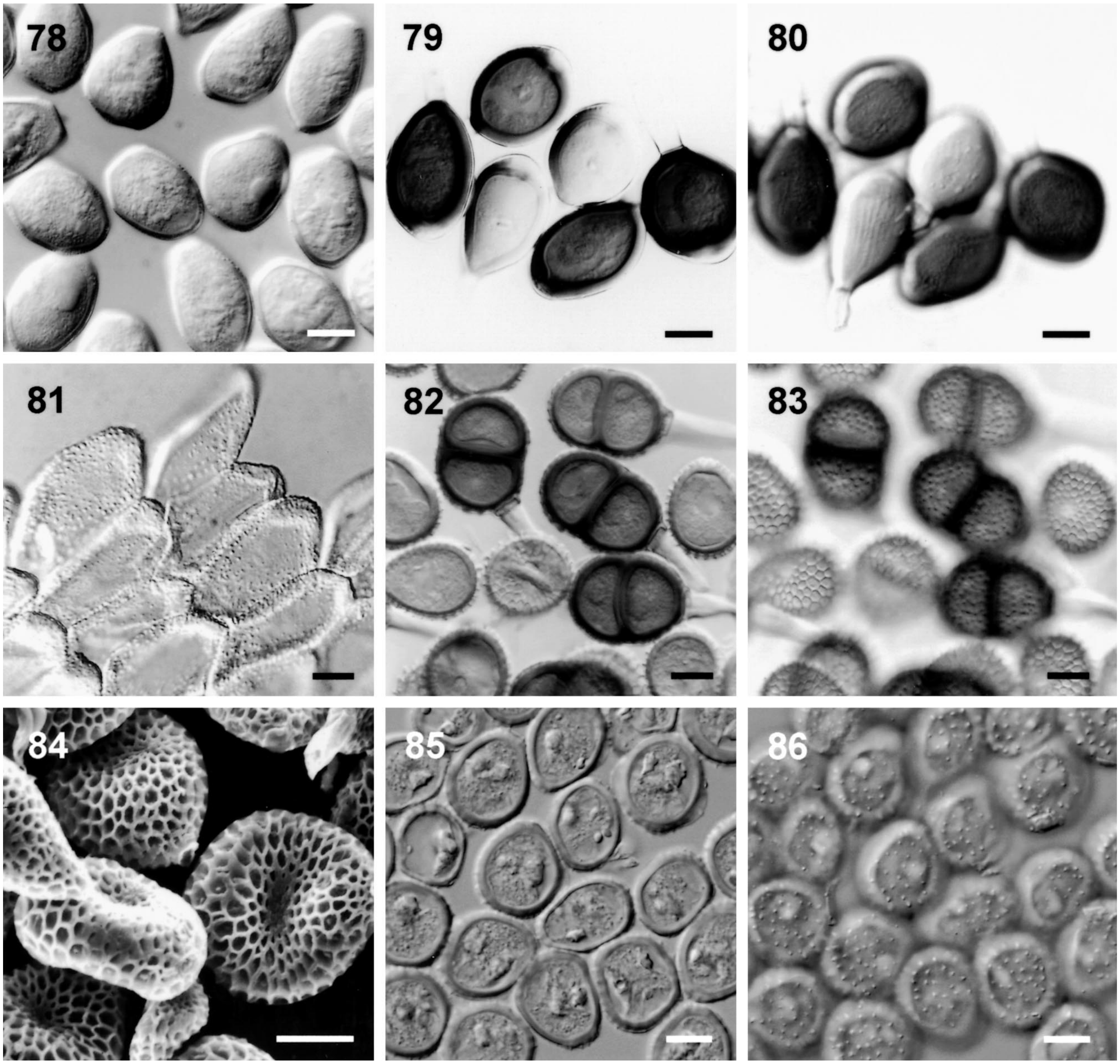
≡ *Aecidium cestri* Mont., Ann. Sci. Nat. Bot. Sér II, 3: 356. 1835.

≡ *Pucciniola cestri* (Mont.) Arthur, N. Am. Fl. 7: 452. 1921.

Spermogonia unknown. Uredinia usually amphigenous or caulicolous, rather loosely grouped or closely circinate in hypertrophied spots, 2–10 mm diam, cupulate or short-cylindric, 0.4–0.8 mm diam, usually 0.2–0.5 mm high, deeply seated in mesophyll, peridium whitish, margin erose, usually not projecting above host tissue; peridial cells irregularly and narrowly oblong or rhomboidal in radial section, 32–58 × 12–23 μm, overlapping, outer wall 1.5–3 μm thick, finely and closely verrucose; urediniospores 25–37 × 19–26 μm, angularly oblong, ellipsoid, or globoid, wall hyaline or yellowish, 1.5–3 μm thick, closely and finely verrucose (more than one pattern of sculpture). Telia usually epiphyllous, loosely grouped in concentric circles, or on spots with uredinia, round or oblong, 0.2–1.2 mm across, early exposed, compact, becoming slightly pulverulent, blackish-brown, ruptured epidermis conspicuous; teliospores 25–35 × 19–26 μm, ellipsoid, oblong, or globoid, rounded or acute above, sometimes slightly narrowed below, wall chestnut-brown, sometimes with hyaline thickening above, 2.5–5 μm thick at sides, 4–8 μm thick at apex, smooth or occasionally closely and inconspicuously verrucose, pedicel hyaline or pale-yellow, once or twice length of spore, fragile.

*Hosts and distribution.*—*Cestrum aurantiacum* Lindl., Guatemala; *C. auriculatum* L'Hér., Bolivia, Peru; *C. diurnum* L., U.S.A.; *C. elegans* (Brongn.) Schltdl., Argentina; *C. hediundinum* Dunal, Peru; *C. kunthii* Francey, Argentina; *C. lanatum* M. Martens & Galeotti, Guatemala; *C. latifolium* Lam., Brazil, Puerto Rico, Virgin Islands; *C. laurifolium* L'Hér., Dominican Republic, Puerto Rico, Virgin Islands; *C. lorentzianum* Griseb., Argentina; *C. macrophyllum* Vent., Dominican Republic, Puerto Rico, Virgin Islands; *C. nitidum* M. Martens & Galeotti, Mexico; *C. nocturnum* L., Puerto Rico, Virgin Islands, U.S.A.; *C. parqui* L'Hér., Argentina, Bolivia, Chile, Uruguay; *C. parviflorum* Dunal, Colombia; *C. pubescens* Roem. & Schult., Bolivia; *C. schlechtendalii* G. Don, Brazil; *C. strigilatum* Ruiz & Pav., Ecuador; *Cestrum* sp., Argentina, Bolivia, Brazil, Chile, Mexico, Peru, Puerto Rico, U.S.A.; substrate undtn., Puerto Rico.

*Specimens examined.*—ARGENTINA. CATAMARCA: El Rodeo. On *Cestrum lorentzianum*, 29 Nov 1997, *J.R. Hernández 97–122* (BPI 841946) [II]. N of Catamarca, Lat. S. 28° 30.186′, Long. W. 65° 39.485′. On *C. lorentzianum*, 22 Sep 1997, *J.F. Hennen & J.R. Hernández 97–020* (BPI 841174) [II]. JUJUY: Santa Catalina. On *Cestrum* sp., 27 Apr 1906, *R. Thaxter s.n.* (BPI 3020) [II-III]. SALTA: Cafayate. On *C. parqui*, 8 Apr 1994, *J.F. Hennen & J.R. Hernández 94–099* (LIL 54929, BPI 841948) [II-III]. *J.F. Hennen & J.R. Hernández 94–099B* (LIL 54931, BPI 841949) [II]. *J.F. Hennen & J.R. Hernández 94–099A* (LIL 54930, BPI 841040) [II- III]. El Potrero. On *C. parqui*, 21 Aug 2001, *J.R. Hernández 01–020* (841777) [II-III]. "camino de corniza" between Salta and Jujuy. On *Cestrum* sp., 7 Dec 1997, *J.R. Hernández 97–176* (BPI 841951) [II]. TUCUMÁN: Alta Gracia. On *C. lorentzianum*, 19 Nov 1997, *J.R. Hernández 97–090* (BPI 841945) [II]. Dept. Trancas. On *C. lorentzianum*, 27 Oct 1995, *J.R. Hernández 95–060* (BPI 841944) [II]. San Pedro de Colalao. On *C. lorentzianum*, 31 Mar 1994, *J.F. Hennen & M.M. Hennen 94–045* (LIL 54937, BPI 841943) [II]. Dept. Capital. On *C. parqui*, 15 Dec 1990, *J.R. Hernández 90–002* (BPI 841947) [II]. San Pedro de Colalao. On *C. parqui*, 8 Jul 2000, *J.R. Hernández 00–014* (BPI 841778) [II-III]. Cevil Pozo, 12–15 km E of San Miguel de Tucumán. On *Cestrum* sp., 30 Mar 1993, *J.F. Hennen & J.R. Hernández 93–053* (LIL 54934, BPI) [II]. Cruz Alta, San Agustín. On *Cestrum* sp., 30 Mar 1994, *J.F. Hennen, M.M. Hennen & J.R. Hernández 94–033* (LIL 54936, BPI) [II].




FIGS. 78–86. *Uromyces cestri*, *Uropyxis rickiana* and *Ypsilospora tucumanensis*. 78. Urediniospores of *U. cestri*, 79, Median view of teliospores of *U. cestri*, 80. Surface view of 79, 81. Peridial cells of *U. cestri*, 82. Median view of aeciospores and teliospores of *U. rickiana*, 83. Surface of 82, 84. SEM of urediniospores of *U. rickiana*, 85. Median view of aeciospores of *Y. tucumanensis*, 86. Surface view of 85. Bars = 10 μm.

Horco Molle, Parque Sierras de San Javier. On *Cestrum* sp., 6 Apr 1994, *J.F. Hennen, M.M. Hennen & J.R. Hernández 94–091B* (LIL 54733, BPI 841950) [II]. Las Cejas. On *Cestrum* sp., 30 Mar 1993, *J.F. Hennen & J.R. Hernández 93–067* (LIL 54935, BPI) [II]. San Javier, Parque Sierras de San Javier. On *Cestrum* sp., 27 Mar 1993, *J.F. Hennen, L.D. Ploper & J.R. Hernández 93–023* (LIL 54932, BPI) [II]. *J.F. Hennen, L.D. Ploper & J.R. Hernández 93–041* (LIL 54933, BPI) [II]. SW of J.B. Alberdi, Lat. S. 27° 39.657′, Long. W. 65° 45.011′. On *Cestrum* sp., 22 Sep 1997, *J.F. Hennen & J.R. Hernández 97–003* (BPI 841162) [II–III].

*Commentary*.—The first valid description of the teleomorph of *Uromyces cestri* was published by Montagne (in Gay 1852). Léveillé (1847) previously had cited the name *Uromyces cestri* Mont. but did not publish a description.

The anamorph has the morphology usually referred to as an *Aecidium*, and the name *Aecidium cestri* has been used. However, we refer to this anamorph as *Uredo cestri* because no spermogonia have been observed or reported.

Uredinia are produced amphigenously on leaf spots and on young branches. *Uromyces cestri* infects the host locally. Leaves become curled and distorted when sori are produced on leaf veins or when numerous infections coalesce. When a young branch is heavily infected, the entire branch becomes distorted and resembles a witches' broom.

***Uropyxis rickiana*** Magnus, Hedwigia 45: 176. 1906. FIGS. 82–84, 89

= *Uropyxis reticulata* Cummins, Mycologia 31: 171. 1939.

Spermogonia amphigenous, forming on hemispherical small or large galls up to 6 cm diam or more and on hypertrophied areas of various sizes on petioles and stems. Aecia developing around spermogonia, dark brown, without paraphyses; aeciospores borne singly on pedicels, variable in size and shape, mostly obovoid, (25–) 28–35 (–36) × (19–) 22–25 (–30) μm, wall 2–3-(–3.5) μm thick, cinnamon to chestnut brown, reticulate with meshes 2–3 μm diam and narrow separating ridges, pores 2, equatorial in slightly flattened sides. Uredinia hypophyllous, small, scattered, not causing hypertrophy, dark brown, without paraphyses; urediniospores mostly obovoid, 25–32 × 21–25 μm, wall 2–2.5 μm thick, about cinnamon-brown, reticulate as aeciospores, pores 2, equatorial. Telia associated with spermogonia and aecia, chocolate brown, forming in fissures of the galls and on leaves with uredinia; teliospores (32–) 35–42 (–46) × (20–) 23–27 (–30) μm, mostly broadly oblong-ellipsoid, wall 2.5–3.5 μm thick, chestnut brown, inconspicuously bilaminate in lactophenol mounts, verrucose with mostly discrete low warts or rounded cones, pores 2 on each probasidial cell, equatorial; pedicel thick-walled, hyaline, terete but rugose in lower ½ or ⅓, persistent, to 100 μm long.

*Hosts and distribution.*—*Macfadyena unguis-cati* (L.) A.H. Gentry (= *Bignonia unguis-cati* L.), Argentina [Buenos Aires, Corrientes (*fide* Lindquist, 1982), Salta, Tucumán], Brazil (Hennen et al 1982); Bignoniaceae undtn., Brazil.

*Specimens examined.*—ARGENTINA. BUENOS AIRES: La Plata, Jardín Botánico, Fac. Agron. On *Macfadyena unguis-cati*, Dec 1946, *Lindquist s.n.* (BPI 114783) [I-III]. SALTA: Dept. Rosario de la Frontera, Horcones. On *M. unguis-cati*, 6 Dec 1997, *J.R. Hernández 97–153* (BPI 841250) [II-III]. Posta de Yatasto. On *M. unguis-cati*, 6 Dec 1997, *J.R. Hernández 97–155* (BPI) [II]. TUCUMÁN: 19.5 km W of San Miguel de Tucumán, mtn. On *M. unguis-cati*, 27 Mar 1993, *J.F. Hennen, L.D. Ploper & J.R. Hernández 93–013* (LIL 54723, BPI) [II-III]. Horco Molle. On *M. unguis-cati*, 15 Mar 1992, *J.R. Hernández 92–002* (BPI) [II-III]. BRAZIL. PARA: Castanhal-mun. On *M. unguis-cati*, 20 Jul 1962, *F.C. Albuquerque 881* (BPI 114782) [II]. On Bignoniaceae undtn., *J. Rick* (BPI 711886) [I-III]. Rio Grande do Sul, Novo Petrópolis. On Bignoniaceae undtn., 1923, *J. Rick* (BPI 122604) [I-III]. SÃO LEOPOLDO: On Bignoniaceae undtn., 1905, *J. Rick* (BPI 122602—ISOTYPE of *U. rickiana*) [I-III].

*Commentary.*—*Uropyxis rickiana* is an autoecious, macrocyclic rust. Galls are produced by infections of the spermogonial, aecial, and telial states (FIG. 89). This species is distinctive particularly because of the reticulate walls of the aeciospores and urediniospores.

Galls are conspicuous and often are seen on the host vines on fences in rural areas. In the forest, the galls are visible on vines that grow around tree trunks or hang from the limbs. Perennial stem infections may produce galls up to 10 cm wide by 25–30 cm long. These galls have a woody and rough surface, and telia probably are produced for many years. On young tissues of the host, small, active galls of a few millimeters or centimeters can be found covered by aecial and telial sori (FIG. 89).

All other species of *Uropyxis* are known from Fabaceae and none have reticulate anamorph spore walls or inconspicuously bilaminate teliospores walls. The fact that *U. rickiana* occurs on Bignoniaceae, the reticulate anamorph spore walls, and the inconspicuously bilaminate teliospore walls, suggest that this species is misplaced in *Uropyxis*, but a better genus in unknown. It was placed in the genus *Uropyxis* because of the presence of two germ pores in each probasidial cell.

Spegazzini (1925, p. 108) reported this rust as *Puccinia bignoniacearum* Speg., which is a different species that belongs in the genus *Prospodium* (Cummins 1939).

***Ypsilospora tucumanensis*** J.R. Hern. & J.F. Hennen *sp. nov.* FIGS. 85, 86, 90–92

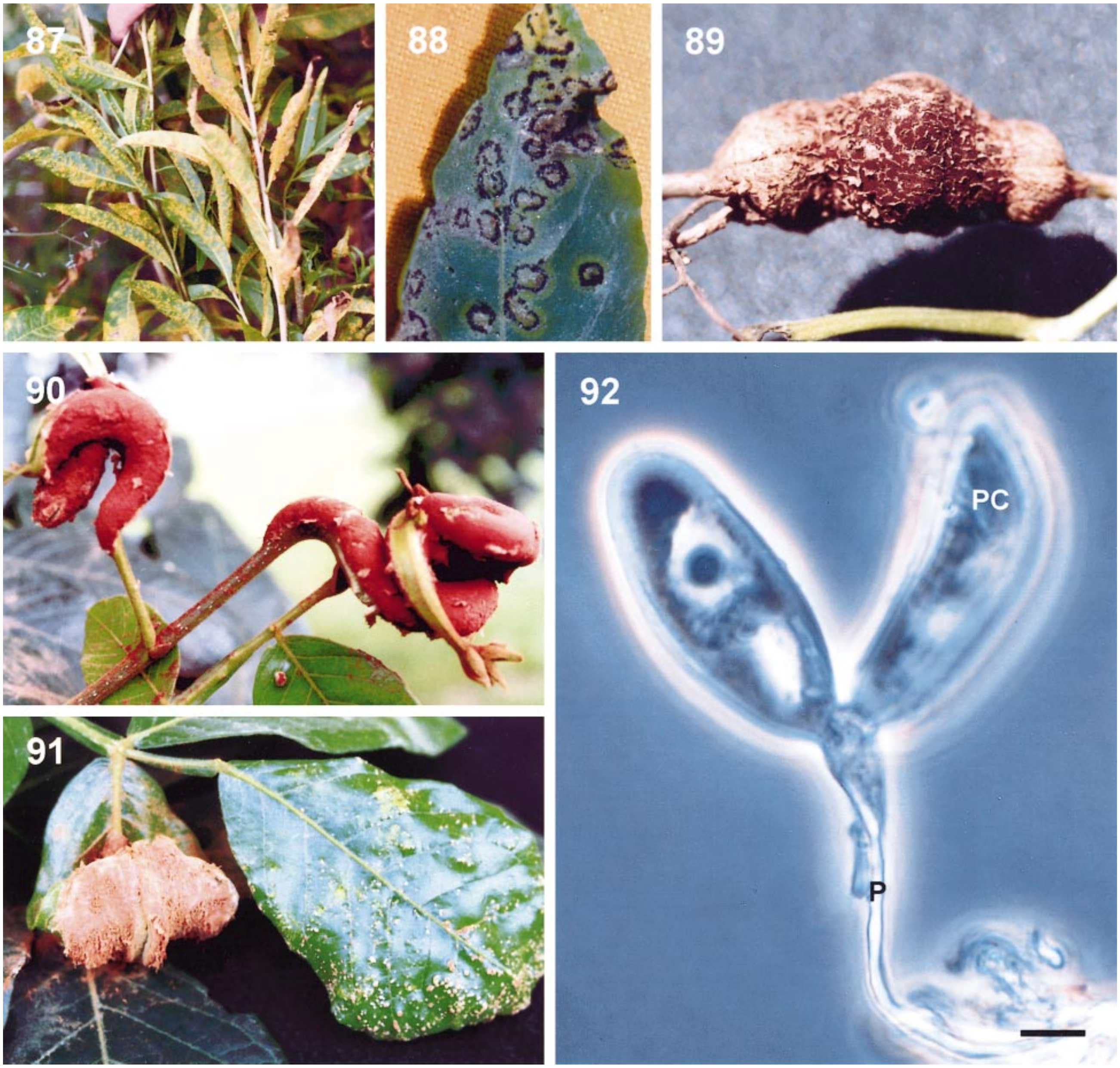
Teliosporae in urediniis, constatae ex duabus libris probasidialibus cellulis affixis ad apicem pedicellorum similium hyphis, aspectu "Y"; utraque probasidialis cellula 30–70 × 10–20 μm, clavata vel angustoellipsoidea, tenui parieti, hyalina, sine porum germinalem.

*Anamorph.* **Uredo ingae** Henn., Hedwigia 38: 69. 1899.

≡ *Ravenelia ingae* (Henn.) Arthur, N. Am. Fl. 7: 132.1907 (name based on anamorph).

≡ *Haploravenelia ingae* (Arthur) Syd., Ann. Mycol. 19: 165. 1921.

= *Uromyces pulverulentus* Speg. Revista Argent. Bot. 1(2a.–3a.): 143. 1925 (name based on anamorph).




FIGS. 87–92. *Uromyces cestri*, *Uropyxis rickiana* and *Ypsilospora tucumanensis*. 87. Uredinia of *U. cestri* on leaves of *Cestrum parqui*, 88. Telia of *U. cestri* on leaf of *C. parqui*, 89. Gall caused by *U. rickiana* on stem of *Macfaydiena unguis-cati*, 90. Aecia on abnormal growth of young branches of *Inga edulis* caused by *Y. tucumanensis*, 91. Aecia on distorted leaves of *I. edulis* caused by *Y. tucumanensis*, 92. Phase contrast of teliospore of *Y. tucumanensis* showing two probasidial cells (PC) on pedicel (P). Bar = 10 μm.

Spermogonia not seen. Aecia amphigenous on hypertrophied leaves, petioles, young buds, branches and flowering parts causing large, brown, powdery abnormal growths, subepidermal in origin, erumpent, without paraphyses; aeciospores pedicellate, obovoid to ellipsoid, short clavate or irregular, attenuate toward base, (16–) 20–22 (–28) × (13–) 14–16 (–17) μm, walls 2–4 μm thick at sides, often a little thicker at apex, hyaline, finely echinulate, germination pores 3–4, equatorial. Uredinia hypophyllous, whitish, scattered; urediniospores similar to aeciospores. Teliospores in uredinia, composed of two, laterally free probasidial cells attached to the distal end of a hypha-like pedicel, suggesting the letter Y, each probasidial cell 30–70 × 10–20 μm, clavate to narrowly ellipsoid, wall thin, hyaline, germ pore not differentiated, metabasidia develop without dormancy by apical elongation of probasidia.

HOLOTYPE: ARGENTINA. TUCUMÁN: San Miguel de Tucumán (Quinta Agronómica). On *Inga ed-*

*ulis* Mart., 25 Aug 2001, *J.R. Hernández 01–021* (BPI 841770) [I-II-III]; LPS, LIL, PUR, LE, B, S—ISOTYPES.

*Hosts and distribution.*—*Inga coriacea* var. *leptopus* (Benth.) J.F. Macbr., Costa Rica; *Inga edulis* Mart., Argentina, Brazil, Guatemala; *Inga fastuosa* (Jacq.) Willd., Venezuela; *Inga leptopus* Benth. (originally erroneously cited as *I. leptopoda* Benth. on Holway's label), Costa Rica; *Inga preussii* Harms, El Salvador; *Inga uruguensis* Hook. & Arn., Argentina; *Inga vera* Willd., Puerto Rico; *Inga* sp., Brazil. [all distribution reports from Mains (1939a) as *Uredo ingae* P. Henn. except Argentina which is herein reported and in Lindquist (1940)].

*Specimens examined.*—ARGENTINA. TUCUMÁN: Dept. Capital, Quinta Agronómica. On *Inga edulis*, 28 Mar 1994, *J.F. Hennen & M.M. Hennen 94–024* (LIL 54817, BPI) [I]; 30 Mar 1993, *J.F. Hennen & J.R. Hernández 93–049* (LIL 54816, BPI 841001) [I]; 6 Apr 1994, *J.F. Hennen, M.M. Hennen & J.R. Hernández 94–096* (LIL 54818, BPI 841038) [II-III]; 20 Jun 2000, *J.R. Hernández 00–009* (BPI 841771) [I-II-III]. BRAZIL. SÃO PAULO: Pinheiros. On *Inga* sp., 17 Mar 1922, *E.W.E. Holway & M.M. Holway 1684* (BPI 18884) [II]. Rio de Janeiro, Petrópolis. On *Inga* sp., 20 Oct 1921, *E.W.E. Holway & M.M. Holway 1235* (BPI 18886) [I]. Santa Catarina, São Francisco Island. On *Inga* sp., Oct 1884, *E. Ule 1591* (BPI 18890) [II], Lectoype of *Uredo ingae*, herein designated. GUATEMALA. SAN FELIPE: Retalhuleu. On *I. edulis*, 14 Jan 1971, *E.W.D. Holway 719* (BPI 18893) [I]. CHINAUTLA. On *I. edulis*, 12 Feb 1916, *E.W.E. Holway 486* (BPI 18892) [II]. COSTA RICA. SAN JOSÉ: On *I. leptopus*, 8 Jan 1916, *E.W.D. Holway 389* (BPI 18896) [II]. Tres Rios. On *I. leptopus*, 17 Jan 1916, *E.W.D. Holway 436* (BPI 18895) II. PUERTO RICO: MAYAGÜEZ. On *I. vera*, 19 Jan 1965, *E.P. Imle* (BPI 18897) [I].

*Commentary.*—Cummins (1941) named *Ypsilospora* as a new genus, with type *Y. baphiae* Cummins, but Thirumalachar and Cummins (1948) and Eboh (1985) concluded that it was synonymous with *Chaconia* because they interpreted the pedicels of the teliospores as sporogenous cells. The genus *Chaconia* has one to several laterally free, thin-walled, hyaline probasidial cells that arise directly from the distal apex of the sporogenous cells without intervening pedicels (Cummins and Hiratsuka 1983). Ono and Hennen (1979) reinstated the genus *Ypsilospora* because they found that the teliospores are composed of two laterally free, hyaline, thin-walled probasidial cells that are produced at the distal end of a elongated pedicel and that the pedicel arises from a sporogenous cell. Cummins and Hiratsuka (2003) accepted *Ypsilospora* as a genus separate from *Chaconia*. We also accept *Ypsilospora* as distinct and as the appropriate genus for this new species. *Ypsilospora tucumanensis* on *Inga* sp. from Tucumán (Argentina) is the first species of this genus to be found in the New World. Only two species, *Y. baphiae* from Sierra Leone and *Y. africana* Y. Ono & J.F. Hennen from Ivory Coast, were described previously. These two African species are known only on *Baphia* sp., Faboideae, Fabaceae (Ono and Hennen 1979, Eboh 1985).

The most obvious symptoms produced by *Ypsilospora tucumanensis* are the large, brown, powdery galls on buds, stems, leaves and pods of the host plant on which the aecia are produced. The galls vary from irregularly spheroid-ovoid to thick spiral-like structures that range in size from a few mm to 4–6 × 15–21 cm. Sori are produced on these galls and we consider these aecia even though we have not seen spermogonia associated with them. Uredinia and telia were found on leaves from trees with those galls. The urediniospores have the same morphology as the aeciospores produced on the abnormal plant growths. That morphological similarity, the fact that they are found in the same tree and the occurrence of teliospores in the uredinia lead us to the conclusion that these are different spore states of the same fungus.

In scrape mounts from these uredinia, sporogenous cells were identified easily because many old urediniospore pedicels remained attached to them. We found teliospores intermixed in these uredinia and occasionally saw a teliospore with two distal probasidial cells and its long pedicel still attached to one of these urediniospore sporogenous cells (FIG. 92). These observations convinced us that the long, thin hyphal strands between the two probasidial cells and the sporogenous cells were pedicels. In these scrape mounts, we also found detached teliospores composed of long pedicels with two distal probasidial cells. In some teliospores metabasidia had developed by apical elongation of the probasidia and some of these metabasidia had sterigmata with basidiospores still attached. Detached basidiospores, some of which had started to germinate, also were present. These observations further support the suggestion that *Ypsilospora* is a genus distinct from *Chaconia*.

*Comparision with Chaconia ingae.*—Aeciospores and urediniospores of *Y. tucumanensis* have been mistaken as part of the life cycle of *Chaconia ingae* (Cummins 1978, Gallegos and Cummins 1981, Hennen et al 1982). Our study shows that the anamorph spores of *Y. tucumanensis* morphologically are different from those of *C. ingae*. The walls of both aeciospores and urediniospores of *C. ingae* are sculptured with very obvious interconnected striae (striate-reticulate) (FIG. 1), whereas the aeciospores and urediniospores of *Y. tucumanensis* are echinulate (FIG. 86). Sori of *C. ingae* are not produced on abnormal growths. Aecia of *Y. tucumanensis* are produced on abnormal growths, but uredinia and telia are produced on leaves. The correct anamorph name for both the uredinia and aecia of *C. ingae* is *Uredo excipulata* Syd. & P. Syd. (1904).

The name *Uredo ingae* Henn. is the appropriate name for the aecial and uredinial anamorphs of *Y. tucumanensis*. Hennings (1899) described symptoms of *Uredo ingae* as horn-shaped deformations on the stems, petioles and fruit (". . . omnimo deformatibus, cornuformibus. . . ") that were brownish yellow and powdery. He described the spores as echinulate. Mains (1939a) correctly excluded *Uredo ingae* as part of the life cycle of *Bitzea ingae* (Syd.) Mains [now *Chaconia ingae* (Syd.) Cummins]. Cummins (1978) illustrated echinulate urediniospores for *C. ingae* and identified these spores as *Uredo ingae*. We agree with Cummins' identification of that anamorph as *Uredo ingae* but conclude that this is an anamorph of *Y. tucumanensis*, not of *C. ingae*. *Uromyces pulverulentus* Speg. is a synonym of *U. ingae* as suggested by Lindquist (1940).

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